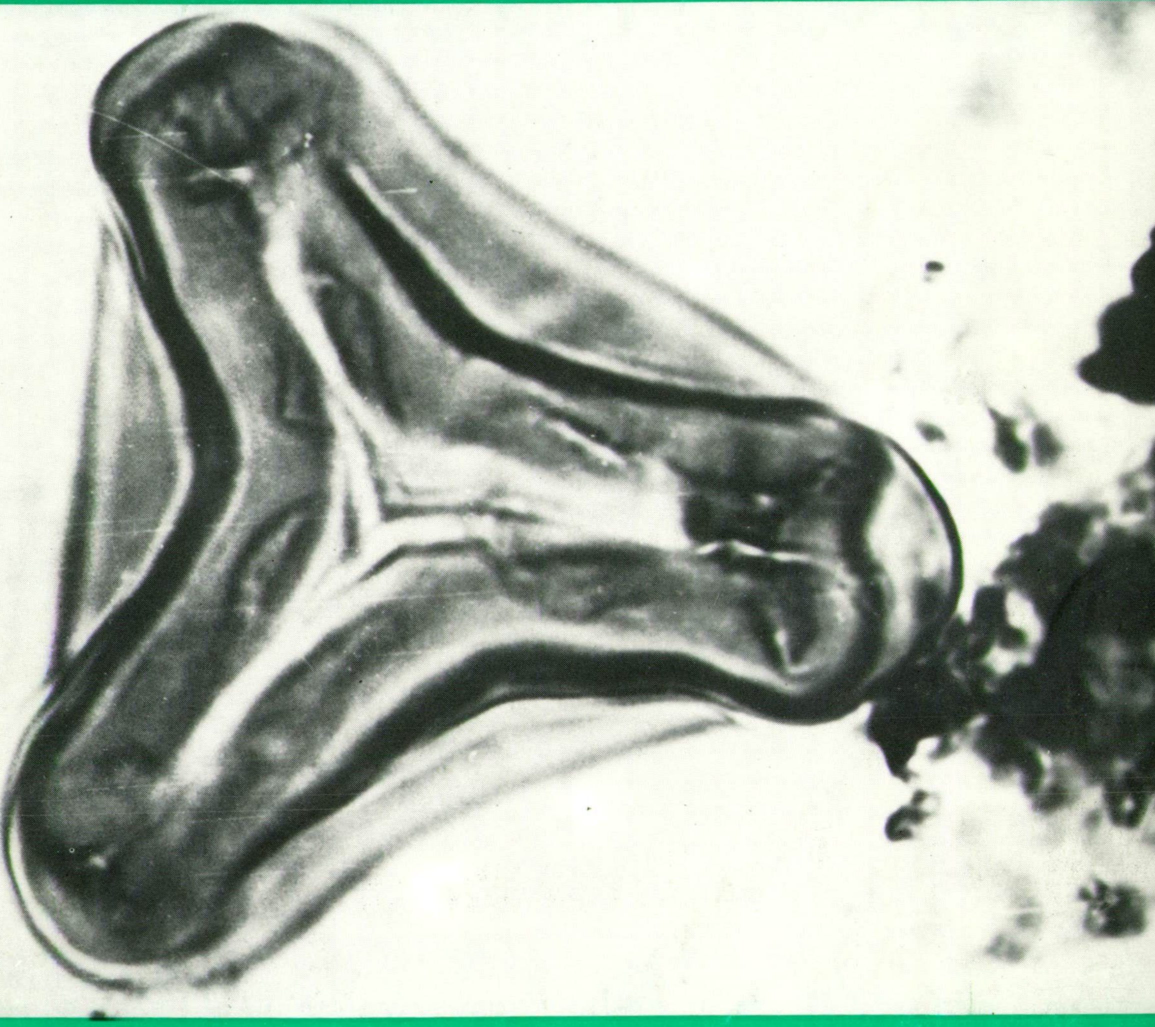
PLANT CELL BIOLOGY AND DEVELOPMENT

EDITED BY

M. KEDVES



Plant Cell Biology and Development

4

Editor: M. Kedves

Financial support

by the Presidium of the Hungarian Academy of Sciences,

by the Regional Committee of the Hungarian Academy of Sciences,

by the Hungarian Oil and Gas Industrial Company,

by the Scientifical and High-educational Committee of the Local Government of Szeged,

by the Grant OTKA 1/3, 104,

by the J. A. University and the Faculty of Sciences

HU ISSN 0866-5443

1993
Szeged

Contents

Contributors

Piroska AILER
: Cell Biological and Evolutionary Micropaleontological Laboratory. Grammar-school Student.

Concepcion ALVAREZ RAMIS
: Department of Palaeontology. Faculty of Geology. U. C. M. Madrid, Spain. University Professor.

Andrea BORBOLA
: Cell Biological and Evolutionary Micropaleontological Laboratory. Grammar-school Student.

Maria Teresa FERNANDEZ MARRÓN
: U. E. I. of Palaeontology. Institut of Economic Geology (C. S. I. C. – U. C. M.) Madrid, Spain. Research Ass. Professor.

Elza GOTTL
: Cell Biological and Evolutionary Micropaleontological Laboratory, Grammar-school Teacher.

Miklós KEDVES
: Cell Biological and Evolutionary Micropaleontological Laboratory. Research Councilor. Honorary Professor.

Irén KINCSEK
: Department of Biology of the J. Gy. High School, Szeged. Ass. Professor.

Katalin MÉSZÁROS
: Cell Biological and Evolutionary Micropaleontological Laboratory. Grammar-school Student.

Árpád PÁRDUTZ
: Institute of Biophysics, Biological Research Center of the Hungarian Academy of Science. Research Ass. Professor.

Imre ROJIK
: Faculty of Sciences of the J. A. University. Laboratory of Electron-microscopy. Research Ass. Professor.

Tibor SZEDERKÉNYI
: Institute of Mineralogy, Geochemistry and Petrography, J. A. University, Szeged. University Professor.

Anita TÓTH
: Cell Biological and Evolutionary Micropaleontological Laboratory. University Student.

Preface

The unexpected decease of Prof. Dr. GY. GRASSELLY touched not only the geochemical and petrographical scientific life but in several respect the Hungarian interdisciplinary research programs, in this way in an important measure our laboratory too.

It is a long time ago, that together with Dr. P. SIMONCSICS we started the investigation of the spore-pollen assemblages of the Hungarian manganese ore layers. These studies represented one part of the complex research program on the manganese ore layers organized by Prof. Dr. GY. GRASSELLY. The paper presented in this subject in this number is the last of this scientific cooperation. The first results on the spore-pollen assemblages of the celadonite layers of Úrkút, together with the supplementary investigations on the Shaft III in Úrkút, were the subject of our last, and unfinished discussions with Prof. Dr. GY. GRASSELLY. A very important scientific cooperation was broken.

This number, which is dedicated to the memory of Prof. Dr. GY. GRASSELLY was published with the generous financial contributions of several institutions and foundations. I would like to express my sincere thanks

to the Presidium of the Hungarian Academy of Sciences, to Dr. D. KOSÁRY, President and Dr. I. LÁNG, Secretary General,

to Dr. GY. TELEGDY President and Dr. T. BALOGH Secretary of the Regional Committee of the Hungarian Academy of Sciences, Szeged,

to the Hungarian Oil and Gas Industrial Company, to Mr. G. JÓZSEF business manager and Mr. Cs. GALÁNFI head of department,

to the Scientifical and High-educational Committee of the Local Government of Szeged,

to Dr. J. CSIRIK, Rector of the J. A. University, and Dr. R. MÉSZÁROS, Dean of the Faculty of Sciences.

Szeged, 15 December, 1992.

M. KEDVES
head of the laboratory

In memoriam

GYULA GRASSELLY
1920–1991

TO THE MEMORY OF PROF. DR. GY. GRASSELLY

T. SZEDERKÉNYI

It was a grievious loss for the Hungarian Academy of Sciences, the József Attila University, his relatives, friends, colleagues and students, Hungarian and universal geology when GYULA GRASSELLY died on 13 November 1991 at the age of 72. He was the head of the Department of Earth Sciences, the vice president of the Regional Committee of the Hungarian Academy of Sciences, Szeged and a merry gentleman brimming with life, who was still in full possession of his creative faculties. With his death, a period of Hungarian geochemical research of manganese and its ore, of which he was the animator and a determinant personality for several decades, came to an end. But the international scientific collaboration that he initiated still survives and gathers all the geologists and geochemists of the world who deal with manganese. Organic geochemistry, which he brought into being in Hungary, and several other Hungarian and international initiations of his are still alive and well.

GYULA GRASSELLY was born on 4th July 1920 in Szeged where he grew up and studied. Having passed his GCE exams with a mark of distinction, he enrolled at the University of Szeged to read chemistry and natural history, and graduated in 1943 with excellent marks. During his last term he studied under professor RAMDOHR in Berlin, where he gained a thorough knowledge of analysis of ores. In 1944 he passed a special pedagogical examination and earned a degree qualifying him as a secondary school teacher of chemistry and natural history.

He worked as a Master of Sciences from 1944, as an assistant lecturer from 1955, and as an assistant professor from 1956 at the Department of Mineralogy and Petrography of Szeged University (later: József Attila University), with professor SÁNDOR KOCH, who was a fatherly friend to him. In 1960 GRASSELLY was got out of the way for political reasons. He was rehabilitated in 1962 and appointed to a professorship in 1964. From 1968 to 1986 he worked as the head of the department, which was enlarged by the addition of geochemical studies, After 46 years of work he retired from the same department where he had started as a young teacher.

During his long career at the university he climbed all rungs of the ladder that can be ascended by a university citizen. He was a demonstrator, a research student, a temporary M. Sc., an M. Sc. and so on up to the appointment to head of the department as a professor. He was the headmaster of EÖTVÖS dormitory for 12 years, the dean of the Faculty of Sciences for 3 years, and a member of the University Council for 13 years. From 1968 to 1986, as the general editor of Acta Mineralogica Petrographica, he made the only Hungarian mineralogical-petrographical-geochemical review well-known world wide. The Ministry of Education also profited from his excellent ability at organizing and solving problems. He was employed for decades as either a member or the leader of several bodies and special committees within the Ministry. His fruitful work was acknowledged by the honourable title of "professor emeritus" from the University Council of JATE and by "The Flag-Order of the Republic" from the President of the Hungarian Republic.

By his own account, GYULA GRASSELLY went through three changes during his career. His love of biology made him interested in natural history, and when he was a first-year student at the university, ZOLTÁN SZABÓ, the headmaster of Eötvös Dormitory and member of the Academy, inspired him to choose chemistry as his second subject. He started to deal with mineralogy in 1941 when professor SÁNDOR KOCH came to Szeged. Professor KOCH became a model for the young demonstrator student on account of his honesty, his passion for his subject and the generous help he gave his students, as well as later on, during his career. So mineralogy became his principal area of study, within which he specialized in mineral chemistry and methods of mineral and ore analysis. This part of his career was closed by his first book, titled "Methods of Mineral and Ore Analysis", published in 1953 by Akadémiai Kiadó.

In 1952 he was made a "candidate in geological and mineralogical studies" for the results that he had achieved. He then made the final and determining change of his career. ELEMÉR SZÁDECZKY-KARDOSS, member of the Academy, asked GRASSELLY to read his handbook on "Geochemistry", published in 1955. According to his own words: "I thought my knowledge of this area was rather imperfect, so I had to work myself into the subject, how I have finally found my sort of work." His efforts were so successful that in 1959, as a result of his research on ionpotencials, the title of Academic Doctor was conferred upon him for his dissertation "The Role and Importance of Complex Anion-Potencials in Geochemistry".

In 1959 he began to devote himself to the mineralogy and geochemistry of the manganese regions of Hungary on behalf of industry. Realizing the number of questions that were waiting to be solved and the necessity of international collaboration, he organized the Commission on Manganese within the Association on the Genesis of Ore Deposits in 1967, and he was the president of the Commission until 1978. In 1974 he initiated the "Genesis of Manganese Ore Deposits" project, within the IGCP (International Geological Correlation Programme), of which he was the leader as well until 1978. The apex of his career is crowned by the monography of three volumes titled „Geology and Geochemistry of Manganese; Mineralogy, Geochemistry, Methods" that he published together with I. M. VARENTSOV in 1980 at Akadémiai Kiadó, which is still a well-known and highly appreciated handbook for researchers of manganese.

There is also another important area of research work that professor GRASSELLY started on the basis of industrial signals. This was a complex geochemical and mineralogical-petrographical analysis of deposits containing organic compounds in order to define the role and effect of different natural factors in the period of their petrification. Essentially, instituting the analysis of insoluble organic compounds, he established the profile of Hungarian organic-geochemical research studies.

Due to his excellent ability to make connections and organize, and the outstanding results of his private research, professor GRASSELLY was elected vice president of the IUGS (International Union for Geological Sciences) from 1972 to 1980 at the XXIVth International Geological Congress in Montreal in 1972. In 1982 he was made the head of the IUGS Advisory Board for the Research Development Programme, and later the leader of the ICL Bureau (the international lithosphere research programme). There has not been another Hungarian geologist for the last 80 years who has held such an important international office. Professor GRASSELLY has had a great influence on the international development of geology with his superb work of organizing and shaping scientific research in the field.

The Advisory Board of the Institution of Cultural Connections, the Hungarian UNESCO Committee, the PUGWASH Hungarian National Committee and the IUGS Hungarian National Committee have also enjoyed the fruits of his estimable international scientific experiences and connections.

The Hungarian Academy of Sciences, in appreciation of the scientific achievements of GYULA GRASSELLY, elected him a corresponding member of the Geochemical Scientific Committee, of which he was the head from 1976 to 1980. Between 1980 and 1986 he was the president of the Geological Scientific Committee. In 1976, at the general meeting of the Hungarian Academy of Sciences he was made a corresponding member, and in 1982 a standard member. His ability to analyze problems, his energy and diplomatic sense had a good effect on the Department of Geological Mining Sciences, as well as on the presidency of the Academy. In 1990 he was elected head of the Department. He could see all the disadvantages of the economic and political changes from a geologist's point of view very clearly, and concentrated his efforts to avoid these problems. He effected changes in the focus of concerns in geology and tried to find its place in the new economic circumstances. While fulfilling this plan successfully, he was carried away by a sudden death.

Professor GRASSELLY always remained a resident of Szeged and was always loyal to the traditions of the city. He also belonged to the group of scientists who have proved that they did not have to work in Budapest to gain worldwide reputation. His positive local patriotism was manifested in several social and scientific activities. He was a member of the Regional Committee of the Hungarian Academy of Sciences Szeged from its foundation, and also its president from 1986 to 1990, and vice president until his death. He "re-organized" – in the real sense of the word – the institution and spread its activities out to all the counties of the South-East, exhilirating an energetic scientific life in them. The city of Szeged appreciated his achievements, career and loyalty with the prize of "Foundation for Szeged". His last activity in Szeged was the hard work of organizing and leading the restoration of the Szeged Centre of Hungarian Academy of Sciences. The beautiful building, that in its function has become worthy of Szeged traditions, still preserves his plane. It is a sad thing that he could not be present at the inauguration of the renewed scientific centre.

A wonderful career has been ended by death. Professor GRASSELLY has left us, getting up from his desk as if he was only leaving for a few minutes before coming back to finish the work that he had been doing. Yet he did not leave anything unfinished! He lived a full life. As an excellent teacher, honoured by both his students and his colleagues, he gained everything that a university professor can. As a scientist, he worked fruitfully until the last minute, and still had time to enjoy the pleasures of life. He was a real human in this sense of the word! Let his final observation stand here as a message for us:

"Without clear ideals, sensible aims, human connections with purpose and responsibility for a larger community of people life is just a dreary vegetating. Noble elevation and internal freedom are needed for all these. The last few decades have much decreased these things. Despite this, I state and I believe that it is high time for us to pull down the "Hungarian Wailing Wall" with new faith and knowledge, by bringing together the values of our small communities and starting a social chain-reaction, we must take upon ourselves the break-through towards the rebirth of the nation."

1. PLANT MICROFOSSILS FROM THE JURASSIC MANGANESE ORE LAYERS OF ÚRKÚT, HUNGARY

M. KEDVES

Cell Biological and Evolutionary Micropaleontological Laboratory of the Department of Botany of the J. A. University, H–6701, P.O. Box 657, Szeged, Hungary

Abstract

This paper summarizes the new results on organic plant microfossils extracted from manganese ore layers in Úrkút. The scope of the new investigations is as follows.
1. First palynological data about the spore-pollen assemblages of the celadonite samples of Úrkút.
2. Cytological stain method was used to get information about the biopolymer organization and biochemistry of the plant microfossils.
3. Supplementary palynostratigraphic data about the Shaft III of Úrkút.

Key words: Palynology, fossil, Jurassic, manganese ore, Úrkút, Hungary.

Introduction

The necessity to investigate the plant microfossil content of the ore layers in Úrkút was emphasized first by GRASSELLY and KLIVÉNYI (1960). The first publications concerning this subject appeared in 1961 (SIMONCSICS and KEDVES). Several papers followed this pioneering information. A synthetic work about Palynology, and the results of all kinds of investigations of the manganese ore layers of Úrkút were published in a special volume of the Ore Geology Reviews – editor: E. I. ROBBINS – with a complete bibliography by KEDVES (1990).

The purposes of the new investigations are as follows.

1. To get first information about the plant microfossil assemblages from the celadonite samples, taking into consideration the pecularities of the diagenesis of this kind of manganese ore.

2. To use new concepts and methods of researches such as the stain methods of Cytology and Histology.

3. To check and/or complete the earlier established palynostratigraphic standards of the manganese ore layers in the region of Úrkút.

Material and Methods

Prof. Dr. Gy. Grasselly, full member of the Hungarian Academy of Sciences gave me the following samples for my investigations:

1. Two samples of the celadonite: "A" — from the basis of Shaft III of Úrkút; "B" — average sample from the celadonite of Shaft III in Úrkút.
2. 21 samples from Shaft III of the carbonate manganese ore layers of Úrkút. This section was sampled from the deep gangway of this shaft.

50 g. from each sample was prepared in the following way. HCl aq. dil. to eliminite the carbonates. Washing with water. Adding cc. HF solving the remainder inorganic matter. Washing — for stain Malachit Green was used. Preparations were mounted in glycerine—jelly hydrated at 39.6%.

The plant microfossil assemblages of the celadonite samples

General establishments:

1. In both samples the plant microfossil remnants are well preserved, and the occurrences are on a high level.

2. The observed plant microfossil taxa are generally identical with the previously published ones, especially in the following papers: Kedves and Simoncsics (1964a,b) Simoncsics and Kedves (1961, 1969).

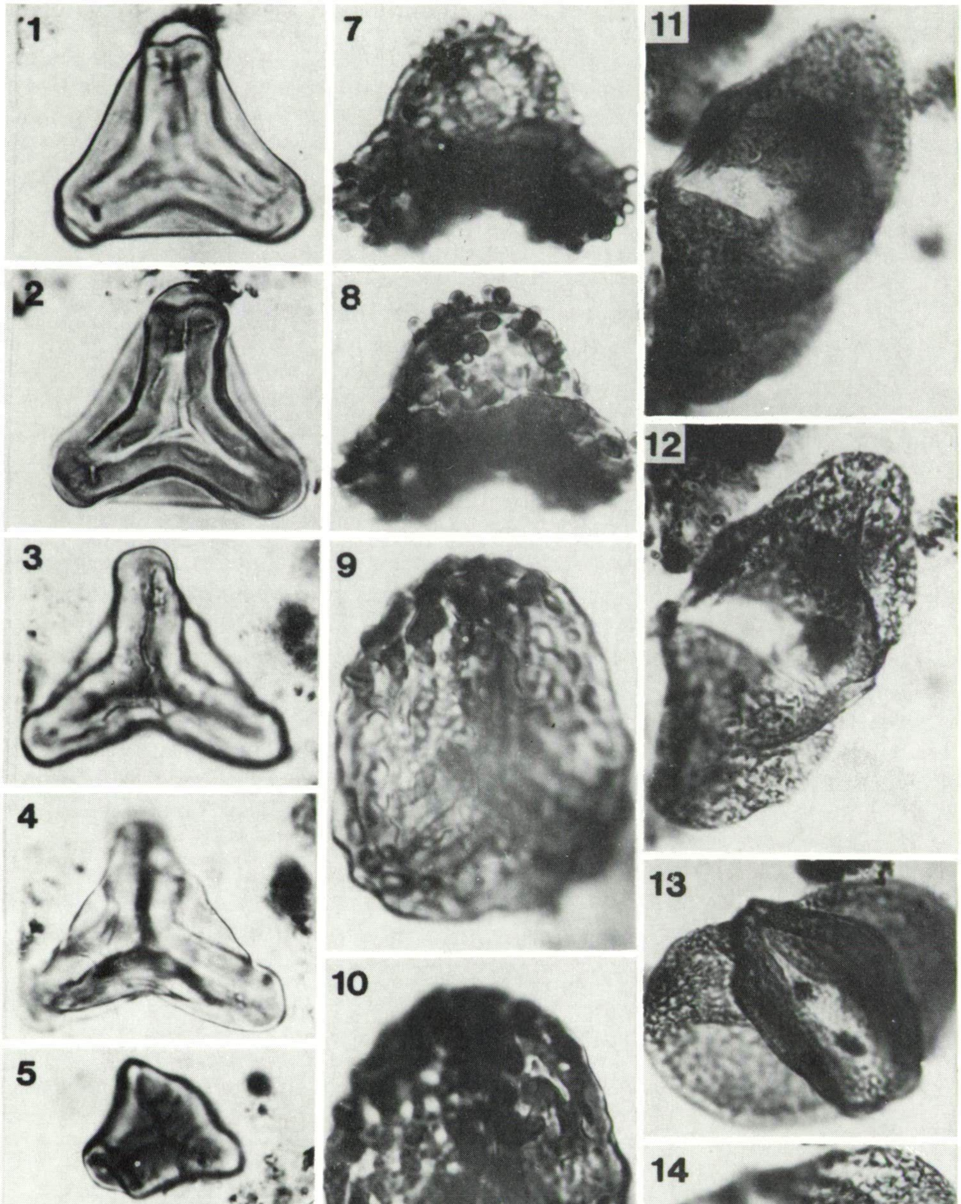
In Plate 1. 1. and 1. 2. the microphotographs of two kinds of microfossils are presented:

1. Some from the so-called classical taxa or types to demonstrate the extremely good preservation of the palynomorphs:

Dictyophyllidites toralis (Leschik 1955) (Plate 1. 1., fig. 1,2),
Dictyophyllidites mortoni De Jersey 1959 (Plate 1. 1., fig. 3,4),
Obtusisporis kara-murzae Kedves and Simoncsics 1964a (Plate 1. 1., fig. 5,6),
Clavatisporites microcapitulus Kedves and Simoncsics 1964a (Plate 1. 1., fig. 7,8),
Dictyotriletes (Klukisporites) variegatus Couper 1958 (Plate 1. 1., fig. 9,10),
Vitreisporites pallidus (Reissinger 1938) Nilsson 1958 (Plate 1. 2., fig. 1,2),
Classopollis classoides (Pflug 1953) Pocock and Jansonius 1961 (Plate 1. 2., figs. 3—6),
Classopollis minor Pocock and Jansonius 1961 (Plate 1. 2., figs. 7—10),
Classopollis cf. *grandis* Simoncsics and Kedves 1969 (Plate 1. 2., fig. 13, 14),

Plate 1. 1. ►

1,2. *Dictyophyllidites toralis* (Leschik 1955), slide: U-III-C-A-5, cross-table number: 21.3/143.5.
3,4. *Dictyophyllidites mortoni* De Jersey 1959, slide: U-III-C-A-1, cross-table number: 14.3/149.2.
5,6. *Obtusisporis kara-murzae* Kedves and Simoncsics 1964a, slide: U-III-C-A-13, cross-table number: 10.6/145.9.
7,8. *Clavatisporites microcapitulus* Kedves and Simoncsics 1964a, slide: U-III-C-A-2, cross-table number: 10.2/141.6.
9,10. *Dictyotriletes (Klukisporites) variegatus* Couper 1958, slide: U-III-C-A-1, cross-table number 16.4/139.1.
11,12. *Pityosporites illustris* Leschik 1955, slide: U-III-C-B-6, cross-table number: 19.3/130.8.
13,14. *Alisporites toralis* (Leschik 1955) Clarke 1965, slide: U-III-C-B-9, cross-table number: 21.2/143.7.
Magnification of all pictures: 1.000x.


1
2
3
4
5
6
7
8
9
10
11
12
13
14

2. Palynomorphs, which were not observed during the previous investigations of the manganese ore layers in Úrkút:

Pityosporites illustris LESCHIK 1955 (Plate 1. 1., fig. 11, 12),
Alisporites toralis (LESCHIK 1955) CLARKE 1965 (Plate 1. 1., fig. 13, 14),
Paracirculina tenebrosa SCHEURING 1970 (Plate 1. 2., fig. 11, 12),
Exesipollenites cf. *tumulus* BALME 1957 (Plate 1. 2., fig. 15, 16),
Exesipollenites scabrosus NORRIS 1969 (Plate 1. 2., fig. 17, 18, cf. 19, 20),
Tasmanites/Tytthodiscus sp. (Plate 1. 2., fig. 21, 22),
Micrhystridium rarispinosum SARJEANT 1960 (Plate 1. 2., fig. 23, 24).

Stain acceptance of the plant microfossils of the celadonite samples

To get information about the chemistry and the biopolymer structure of the plant microfossils, staining with Malachit Green was used. This stain well indicates the presence of the aromatic lignin derivates in the microscopic remnants. On the basis of stain acceptance the following groups were established:

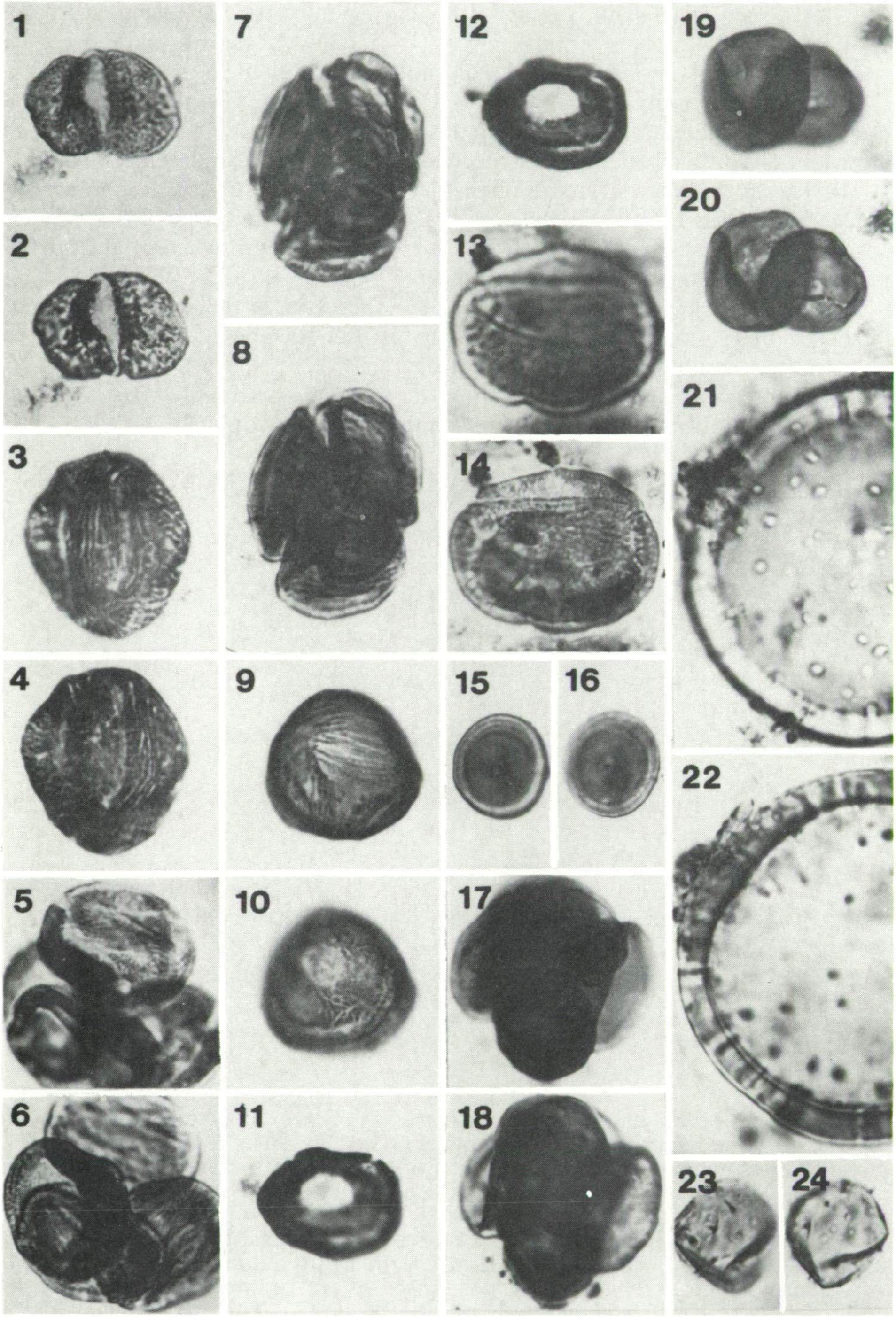
Brown coloured (B); in this case the plant cell wall adsorbed well the manganese ions and manganese oxides have been accumulated. In all probability the anionic character of the surface of the sporomorphs is important in this case. But it is necessary to point out as another factor the alterations of the electrostatic charge of the surface. It may be presumed that the surface has lost its electrostatic charge.

Brown-green coloured (BG); In all probability the surface has not lost its electrostatic charge, and in this way cations were adsorbed on the surface, mostly of Mn. But the exine layers, containing aromatic lignin derivates have accepted

Plate 1. 2. ▶

1,2. *Vitreisporites pallidus* (REISSINGER 1938) NILSSON 1958, slide: U-III-C-A-4, cross-table number: 12.6/132.8.
3,4. *Classopollis classoides* (PFLUG 1953) POCOCK and JANSONIUS 1961, slide: U-III-C-B-15, cross-table number: 23.2/142.3.
5,6. *Classopollis classoides* (PFLUG 1953) POCOCK and JANSONIUS 1961, slide: U-III-C-A-5, cross-table number: 11.8/141.8.
7,8. *Classopollis minor* POCOCK and JANSONIUS 1961, slide: U-III-C-A-7, cross-table number: 9.8/140.1.
9,10. *Classopollis minor* POCOCK and JANSONIUS 1961, slide: U-III-C-B-5, cross-table number: 21.3/145.7.
11,12. *Paracirculina tenebrosa* SCHEURING 1970, slide: U-III-C-B-15, cross-table number: 21.4/133.3.
13,14. *Classopollis* cf. *grandis* SIMONCSICS and KEDVES 1969, slide: U-III-C-A-6, cross-table number: 9.9/136.6.
15,16. *Exesipollenites* cf. *tumulus* BALME 1957, slide: U-III-C-A-4, cross-table number: 8.8/140.5.
17,18. *Exesipollenites scabrosus* NORRIS 1969, slide: U-III-C-B-17, cross-table number: 21.3/243.8.
19,20. *Exesipollenites* cf. *scabrosus* NORRIS 1969, slide: U-III-C-B-7, cross-table number: 8.4/145.6.
21,22. *Tasmanites/Tytthodiscus* sp., slide: U-III-C-B-17, cross-table number: 21.3/143.8.
23,24. *Micrhystridium rarispinosum* SARJEANT 1960, slide: U-III-C-B-21, cross-table number: 13.2/134.9.

Magnification of all pictures: 1.000x.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24

Malachit Green. This stain is peculiar for the lignin containing secondary xylem walls.

Green (G); at the near perfect coloration of the plant microfossil wall, two things may be pointed out:

i. The accumulation of the lignin derivates is on a high level, and there is no important alteration in the basic molecular structure of these derivates.

ii. The biopolymer structure of the surface is unable to accept cations. The surface has lost its electrostatic charge or original character.

On the basis of the new results on the biopolymer structure the surface pecularities are much more complicated than believed earlier.

Yellow (Y); in the first place there are the cysts of the *Algae* which have preserved their original colour. The high carotenoid and its polymer content seems not to be altered to an important degree.

The percentages of the most important plant microfossil types and their distribution following their colour are summarized as follows.

Sample U-III-C-A, basis of Shaft III, of Úrkút

	B	BG	G	Y	Total
Pteridophyta	24.0	3.0	0.5		27.5
Classopollis	9.0	50.1	2.0		61.1
Monosulcites		2.0			2.0
Vitreisporites		0.5			0.5
Eucommiidites		0.5	4.0		4.5
Spheripollenites		2.0	1.2		3.2
Algae (Pleurozonaria, etc.)				1.2	1.2
					100.0

Sample U-III-C-B, average sample from the celadonite of the Shaft III of Úrkút

	B	BG	G	Y	Total
Pteridophyta	1.0	1.0	0.6		2.6
Classopollis	7.0	13.2	1.5		21.7
Monosulcites	0.6	3.0			3.6
Vitreisporites		0.6			0.6
Eucommiidites		0.6	1.5		2.1
Spheripollenites	13.0	46.0	7.2		66.2
Algae (Pleurozonaria, etc.)				1.0	1.0
Hystrichosphaeridae	0.6	0.6	1.0		2.2
					100.0

The spore-pollen assemblage of sample "A" represents well the *Classopollis* zone, established earlier (KEDVES and SIMONCSICS 1964a, KEDVES 1990). It is worth mentioning that the pollen grains of *Cycadaceae* are relatively very few. But *Pteridophyta* is well represented with high quantity of well preserved different kinds of spores.

The average sample "B" may not represent one single previously established microstratigraphical level of Shaft III in Úrkút. But the dominant quantity of the form-genus *Spheripollenites* indicates that several samples come from the *Spheripollenites* zone, which represents the "Zone C". This is the upper part in the microstratigraphical zonation of Shaft III in Úrkút. The occurrence of *Hystrichosphaeride* is also important.

Palynological stratigraphy of the deep gangway of shaft III in Úrkút

(Text-fig. 1. 1.)

The spore-pollen taxa observed during the light-microscopical investigations are identical with the previously published ones. The percentages of the most important groups are illustrated in text-fig. 1. 1. On the basis of these quantitative data the following paleoecological, respectively microstratigraphical conclusions can be established.

OPEN SWAMP ZONE (*PTERIDOPHYTA* AND *SPHERIPOLLENITES*)

(Sample I. 318 m., green, grey and red flint containing limestone).

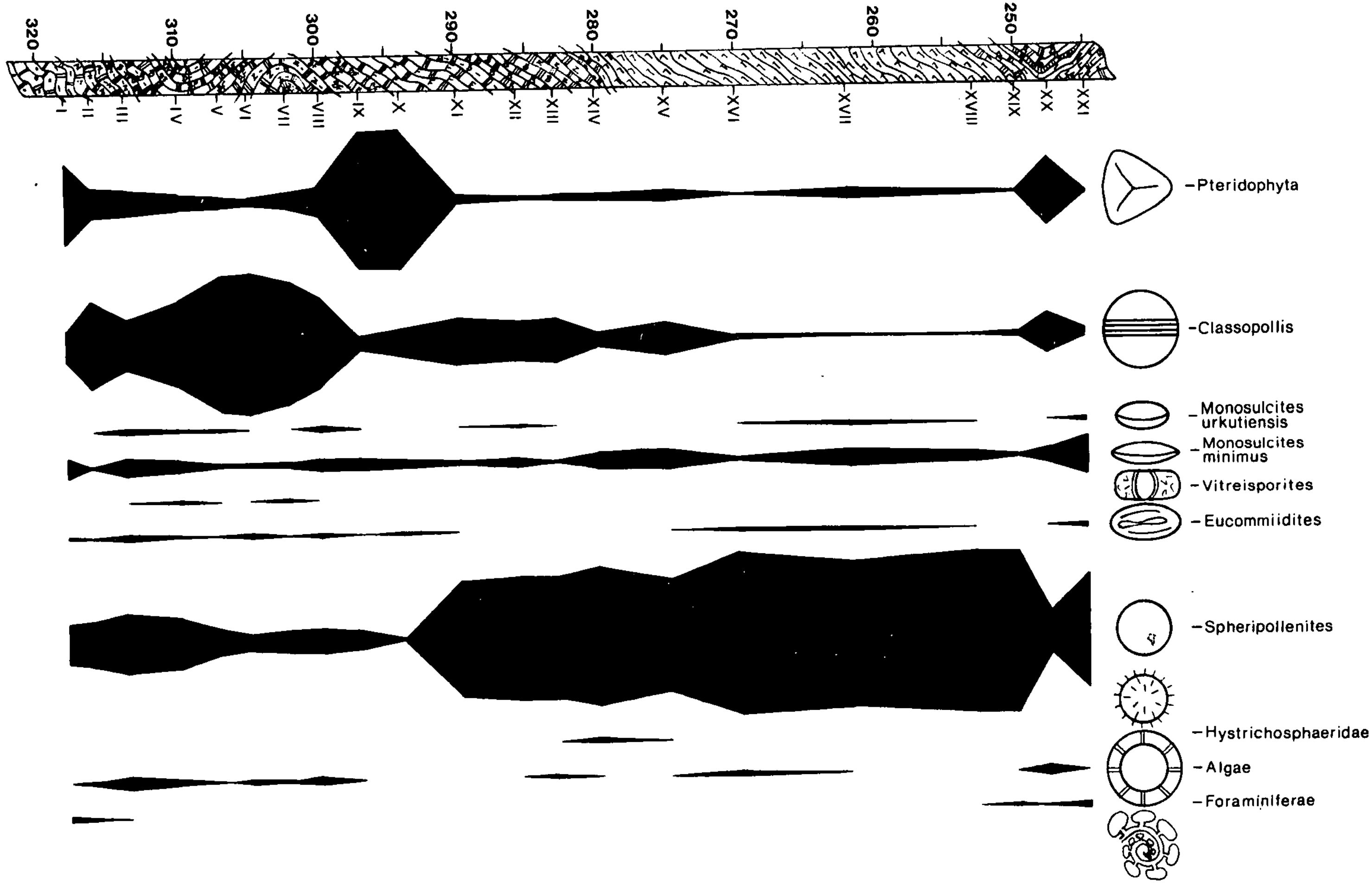
The quantity of the *Pteridophyta* spores is dominant (22.5%). The percentages of the pollen grains of the form-genus *Spheripollenites* are the highest among the gymnosperm types (11.0%). Worth of mentioning are the quantities of the pollen grains of the genus *Classopollis* and *Monosulcites minimus*. The presence in a low quantity is important of the chitionus shells of the *Foraminiferae,* indicating the salt water conditions.

CLASSOPOLLIS ZONE

(Samples II—VIII; II. 316 m., grey, green, finely streaked carbonaceous manganese ore, III. 314 m., IV. 310 m., and V. 307 m., brown, grey, finely streaked carbonaceous manganese ore, VI. 305 m., green — grey coarsely streaked carbonaceous manganese ore, VII. 302 m., green — grey carbonaceous ore, VIII. 300 m., brown, coarsely streaked carbonaceous ore).

The dominance of the pollen grains of the genus *Classopollis* is characteristic, exceptionally sample No III. As regards the details the following can be mentioned.

Sample No II. The quantity of the *Pteridophyta* spores, and of the pollen grains of the genus *Spheripollenites* is relatively high. *Foraminiferal* shells also occur together with algal cysts. In the microfossil assemblage of sample No III. the pollen grains of the genus *Classopollis,* and *Spheripollenites* are predominant. The quantity of the algal cysts, and the *Pteridophyta* spores is relatively high. In the following sample (No IV.), the pollen genus of *Classopollis* is predominant, but the quantities of the algal cysts and the *Pteridophyta* spores, and the pollen grains of *Monosulcites minimus* and *Spheripollenites* are also common. High dominance of the pollen grains of genus *Classopollis* is characteristic for the spore-pollen assemblage of the samples No V., VI., and VII. The presence of the algal cysts and the further previously mentioned plant microfossils is also worth of mentioning.



320
310
300
290
280
270
260
250
I
II
III
IV
V
VI
VII
VIII
IX
X
XI
XII
XIII
XIV
XV
XVI
XVII
XVIII
XIX
XX
XXI
Pteridophyta
Classopollis
Monosulcites urkutiensis
Monosulcites minimus
Vitreisporites
Eucommiidites
Spheripollenites
Hystrichosphaeridae
Algae
Foraminiferae

◄ Text-fig. 1. 1.

Drawing of the profil investigated with the diagram of organic microfossil remains.

PTERIDOPHYTA OXIDIZING ZONE

(Samples IX., 297 m. and X., 294 m., black finely streaked carbonaceous manganese ore).

The preservation of the organic remains is extremely bad. The predominant percentages of the spores are in all probability the consequence of selective fossilization. After all, the position of this layer is peculiar, because this represents the bordering between the *Classopollis* and the *Spheripollenites* zone.

SPHERIPOLLENITES ZONE

(Samples XI—XXI; XII. 286 m., brown (green) coarsely streaked carbonaceous ore, XIV. 280 m., grey coarsely streaked carbonaceous ore).
Clayey marl with *Radiolaria:* Sample XVI., 270 m., XVII. 262 m., XVIII. 253 m.
Sample XIX. 250 m., grey green coarsely streaked carbonaceous ore (Shaft II.).
Sample XX. 248 m., calcareous marl with *Ammonites.*
Sample XXI. 245 m., quartzose bench.

Taking into consideration the lithology of the above mentioned samples it is necessary to point out the following.

Here we have samples from the clayey marl with *Radiolaria,* the top-layer of the manganese ore layers of Shaft III. One sample represents the manganese ore from Shaft II., and its top-layer with *Ammonites.* The quartzose bench is important in connection with the occurrence of celadonite in the manganese ore layers of Úrkút. In this way it is the best to take into consideration the above mentioned lithological data in the fine differences of the spore-pollen assemblages.

The upper part of the carbonaceous manganese ore layers — except the uppermost sample (No XIV.) — contains a remarkable quantity of *Classopollis,* together with the dominant pollen grains of *Spheripollenites.* In the clay marl, with *Radiolaria,* except its lowermost sample the high dominance of the pollen grains of *Spheripollenites* is characteristic. The same spore-pollen composition was found in the manganese ore sample of Shaft II.

In the calcareous marl with *Ammonites,* the *Pteridophyta* spores are dominant with high quantity of *Classopollis* pollen grains. The relatively high amount of the cysts of the *Algae* indicates open swamp conditions.

The spore-pollen composition of the quartzose bench can be characterized by the dominance of *Spheripollenites* with *Monosulcites minimus.* The occurrence of the chitinous shells of *Foraminifera* is worth of mentioning.

Discussion and Conclusions

Concerning our new results it is necessary to emphasize the palynological data of the celadonite samples. Following the monograph of KOCH et al. (1967) celadonite is similar to glauconite. The first occurrence of celadonite is in basalt or in general volcanic rocks. The origin of the celadonite layers of the manganese ore layers is in all probability volcanic nearly submarine hydrothermic (rift). The excellent preservation of the sporomorphs in these samples can be emphasized. The stain acceptance was in this case a first attempt to demonstrate this new opportunity to get more information about the alterations of the organic material during the deposition of the minerai manganese.

The new palynostratigraphic data complete our earlier knowledge concerning this subject. The few data from Shaft II., and calcareous marl with *Ammonites* and the quartzose bench are new remarkable additions. But it seems that in the further detailed investigation of the upper and underlying can yield more interesting data for the elucidation of this interesting problem.

Acknowledgements

This work was supported by grant OTKA 1/3, 104.

References

BALME, B. E. (1957): Spores and Pollen grains from the Mesozoic of Western Australia. — Commonwealth Scient. Ind. Res. Org. Coal Res. *25,* 1—48.

CLARKE, R. F. A. (1965): Keuper miospores from Worchestershire, England. — Palaeontology *8,* 322—354.

COUPER, R. A. (1958): British Mesozoic microspores and pollen grains. — Palaeontographica B, *103,* 75—179.

DE JERSEY, N. J. (1959): Jurassic spores and pollen grains from the Rosewood Coalfield. — Min. J. Queensl. *60,* 346—366.

GRASSELLY, GY. and KLIVÉNYI, É. (1960): Data on the phosphorus content and organic remains of manganese oxide ores from Úrkút. — Acta Miner. — Petr. Szeged *12,* 3—8.

KEDVES, M. (1990): Palynological studies on manganese ore layers in Úrkút (Transdanubia), Hungary. In: Palynology of Ore Deposits, ed.: E. I. ROBBINS, Ore Geol. Rev. *5,* 491—507.

KEDVES, M. and SIMONCSICS, P. (1964a): Microstratigraphy of the carbonate manganese ore layers of the shaft III of Úrkút on the basis of palynological investigations. — Acta Miner. — Petr. Szeged *16,* 3—48.

KEDVES, M. and SIMONCSICS, P. (1964b): Spores nouvelles extraites de minerai de manganèse jurassique de la région dÚrkút (Hongrie). — Pollen et Spores *6,* 605—610.

KOCH, S., SZTRÓKAI, K. I. and GRASSELLY, GY. (1967): Mineralogy II. (In Hungarian). — Tankönyvkiadó, Budapest.

LESCHIK, G. (1955): Die Keuperflora von Neuevelt bei Basel II. Die Iso- und Mikrospores. — Schweiz. Paläont. Abh. *72,* 1—70.

NILSSON, T. (1958): Über das Vorkommen eines mesozoischen Sapropelgesteins in Schonen. — Lunds Univ. Arsskr. *2,* 1—111.

NORRIS, G. (1969): Miospores from the Purbeck Beds and marine Upper Jurassic of southern England. — Palaeontology *12,* 574—620.

PFLUG, H. D. (1953): Zur Entstehung und Entwicklung des angiospermiden Pollens in der Erdgeschichte. — Palaeontographica B, *95,* 60—171.

Pocock, S. J. and Jansonius, J. (1961): The pollen genus *Classopollis* Pflug 1953. — Micropaleontology *7,* 439—449.

Reissinger, A. (1938): Die "Pollenanalyse" ausgedehnt auf alle Sedimentgesteine der Geologischen Vergangenheit II. — Palaeontographica B, *90,* 99—126.

Sarjeant, W. A. S. (1960): Microplankton from the Corallian Rocks of Yorkshire. — Proc. of the Yorkshire Geol. Soc. *32,* 389—408.

Scheuring, B. W. (1970): Palynologische und palynostratigraphische Untersuchungen des Keupers im Bölchentunnel (Solothurner Jura). — Mém. suisses Paléontol. *88,* 1—119.

Simoncsics, P. and Kedves, M. (1961): Paleobotanical examinations on manganese series in Úrkút (Hungary, Transdanubia). — Acta Miner. — Petr. Szeged *14,* 27—57.

Simoncsics, P. and Kedves, M. (1969): The pollen grains of the carbonate manganese ore of the shaft III in Úrkút. — Acta Miner. — Petr. Szeged *19,* 85—94.

2. SOBRE POLENES BREVIAXONES PROCEDENTES DEL CRETÁCICO SUPERIOR DEL BORDE SUR DE LA SIERRA DE GUADARRAMA (PROVINCIA DE MADRID, ESPAÑA)

M. KEDVES[1], C. ALVAREZ RAMIS[2] y M. T. FERNÁNDEZ MARRÓN[3]

1. Laboratório de Biologia celular y Micropaleontologia evolutiva, Departamento de Botánica, Universidad J. A., H–6701, Apartado Postal 657, Szeged, Hungria, 2,3. U. E. I. – Departamento de Paleontologia, Instituto de Geológia Economica, Facultad de Ciencias Geológicas, 28040 Madrid, España

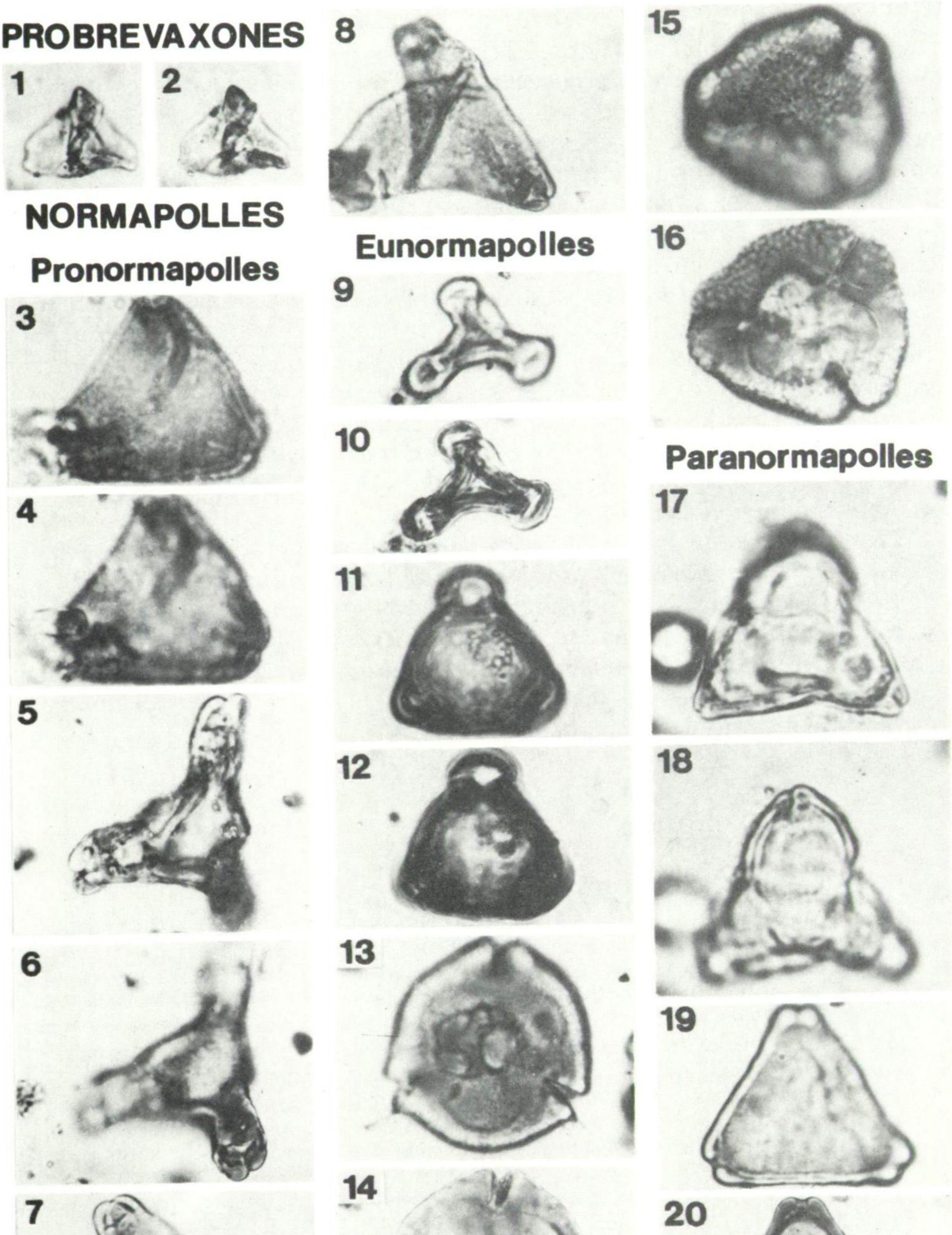
Como resultado de los estudios palinológicos que el grupo de trabajo de Paleobotánica de Madrid ha realizado, de acuerdo con distintos proyectos de investigación a lo largo de más de diez años sobre la flora del Cretácico superior de la Sierra de Guadarrama, se están llevando a cabo colaboraciones con varios especialistas extranjeros. Se han efectuado numerosas publicaciones relacionadas con los pólenes de las *Angiospermas* (ALVAREZ RAMIS y DOUBINGER, 1980, MÉDUS y ALVAREZ RAMIS, 1989, ALVAREZ RAMIS, KEDVES y FERNÁNDEZ MARRÓN, 1992).

La importancia que para las dataciones representa la abundancia o no de tipos de pólenes *Breviaxones* (formas mayoritarias entre los *Normapólenes*) en relación con los *Longiaxones* (mayoritarios entre las restantes *Angiospermas*) hace que el estudio morfográfico de sus tipos nos pueda proporcionar datos de sumo interés en cuanto a la posición estratigráfica de los distintos yacimientos, lo que motivó la petición de colaboración a uno de los firmantes de este trabajo. La colaboración se plasmó en el proyecto "Estudio de diversos aspectos paleobotánicos del Cretácico Superior del Cerro de la Mesa (Madrid)" asumido por la Dirección General de Cooperación Cientifica y Técnica del Ministerio de Asun-

Lamina 2. 1. ▶

1,2. *Bolchovitinaepollenites miniverrucatus* KEDVES et DINIZ 1981, Cerro de la Mesa 1/7; 11,9/132,8.
3,4. *Atlantopollis microrugulatus* KEDVES et DINIZ 1979, Cerro de la Mesa 2/4; 9,8/135,4.
5,6. *Complexiopollis vancampoae* DINIZ, KEDVES et SIMONCSICS 1974, Cerro de la Mesa 5/6; 14,8/132,0.
7,8. *Complexiopollis patulus* TSCHUDY 1973, Cerro de la Mesa 5/5; 23,9/135,4.
9,10. *Interporopollenites vancampoae* KEDVES et HEGEDÜS 1975, Cerro de la Mesa 6/2; 14,6/146,6.
11,12. *Interporopollenites subgranulosus* KEDVES et HEGEDÜS 1975, Cerro de la Mesa 4/8; 8,3/142,4.
13,14. *Papillopollis vancampoae* KEDVES et PITTAU 1979, Cerro de la Mesa 5/8; 8,6/145,4.
15,16. *Aveiropollenites triangulus* KEDVES et DINIZ 1980–1981, Cerro de la Mesa 2/1; 12,6/137,3.
17,18. *Rocheipollenites triangulus* KEDVES et DINIZ 1980–1981, Los Alcores 1/1; 22,5/143,9.
19,20. *Vacuopollis orthopyramis* PFLUG 1953 f. *magna* KEDVES et DINIZ 1980–1981; Los Alcores 1/7; 21,3/145,6.

Todos los ejemplares están aumentados por mil.


PROBREVAXONES
1
2
NORMAPOLLES
Pronormapolles
3
4
5
6
7
8
Eunormapolles
9
10
11
12
13
14
15
16
Paranormapolles
17
18
19
20

tos Exteriores. El convenio, aprobado por la comisión Mixta Hispano–Hungara, tiene una duración bianual (1992–1993).

En éste trabajo se dan a conocer algunos de los diferentes tipos polínicos hallados en el Cretácico superior de la provincia de Madrid (de acuerdo con las agrupaciones definidas por KEDVES en 1981) y se figuran los pólenes más representativos que forman parte de ellas.

Hay que destacar en el yacimiento del Cerro de la Mesa la presencia del género-forma *Atlantopollis,* bien representado por los tipos más modernos; dentro del morfogénero *Complexiopollis, C. vancampoae* es una de las formas primitivas. Ambos morfogéneros están bien representados en nuestros yacimientos del Borde meridional de la Sierra de Guadarrama. En comparación con los datos del Cenomanense superior-Turoniense de Vila Flor en Portugal son menos frecuentes.

En el yacimiento portugués de Aveiro (Santoniense – Campaniense) son abundantes las formas de *Interporopollenites, Papillopollis* y *Vacuopollis* y en menor proporción *Rocheipollenites triangulus* y *Aveiropollenites triangulus* que son dominantes en el Cerro de la Mesa.

La afinidad entre las asociaciones palinológicas supracretácicas estudiadas en España y Portugal es manifiesta, aunque con ciertas diferencias.

En los yacimientos del supracretácico del Norte de la provincia de Madrid son muy abundantes las formas de *Interporopollenites, Papillopollis* y *Vacuopollis* y bastante frecuentes *Rocheipollenites* y *Aveiropollenites.* Esta circunstancia parece situar los niveles de procedencia de los palinomorfos estudiados en el yacimiento del Cerro de la Mesa como al menos Campaniense.

Bibliografía

ALVAREZ-RAMIS, C. y DOUBINGER, J. (1980): Los microfósiles vegetales del Cretácico superior de Torrelaguna (Madrid). – Bol. R. Soc. Española Hist. Nat. (Geol.) *78,* 205–215.

ALVAREZ-RAMIS, C. y FERNÁNDEZ MARRÓN, M. T. (1990): Caracterización palinologica del Cretacico superior del Cerro de la Mesa (Guadalix de la Sierra, Madrid). – 8 Simposio de Palinologia A. P. L. E. Resumenes, Tenerife (Islas Canarias), 67.

ALVAREZ-RAMIS, C., KEDVES, M. y FERNÁNDEZ MARRÓN, M. T. (1992): Asociaciones esporopolínicas del Cretácico superior del Cerro de la Mesa (Guadalix de la Sierra, provincia de Madrid). – 9 Simposio de Palinogia A. P. L. E. Resúmenes, Las Palmas de Gran Canaria, 28.

DINIZ, F., KEDVES, M. et SIMONCSICS, P. (1974): Les sporomorphes principaux de sédiments crétacées de Vila Flor et de Carrajão, Portugal. – Com. dos Serv. Geol. de Portugal *58,* 161–178.

KEDVES, M. (1981): Definitions of, evolutionary trends within, and classification of early brevaxonate pollen. – Rev. Palaeobot., Palynol. *35,* 149–154.

KEDVES, M. et DINIZ, F. (1967): Quelques types de sporomorphes de sédiments crétacés d'Aveiro, Portugal. – Com. dos Serv. Geol. de Portugal *52,* 17–25.

KEDVES, M. et DINIZ, F. (1979): Les pollens d'Angiospermes du Crétacé de Vila Flor, Portugal. Genres de forme *Atlantopollis* et *Limaipollenites.* – Bol. Soc. Geol. de Portugal *21,* 203–216.

KEDVES, M. et DINIZ, F. (1980–1981): Contribution à la connaissance des pollens d'*Angiospermes* du Crétacé supérieur du Portugal. – Bol. Soc. Geol. de Portugal *22,* 19–32, 4 pl.

KEDVES, M. and DINIZ, F. (1981): *Probrevaxones,* a new pollen group for the first *Brevaxones* form-genera from the Upper Cenomanian of Portugal. – Acta Bot. Acad. Sci. Hung. *27,* 383-402.

KEDVES, M. and HEGEDÜS, M. (1975): Pollen grains of the *Interporopollenites* fgen. from sediments of the Upper Cretaceous period in Portugal. — Acta Biol. Szeged, *21,* 43—62.

KEDVES, M. et PITTAU, P. (1979): Contribution à la connaissance de pollens du "groupe papilloide" du Crétacé supérieur de Portugal. — Pollen et Spores *21,* 169—209.

MÉDUS, J. et ALVAREZ-RAMIS, C. (1989): Des pollens *Normapolles* d'un niveau du Crétacé supérieur de la Région de Guadalix, Prov. de Madrid, Espagne. — Revista Española de Micropaleontologia *21,* 139—144.

PFLUG, H. D. (1953): Zur Entstehung und Entwicklung des angiospermiden pollens in der Erdgeschichte. — Palaeontographica *B, 95,* 60—171.

ROBASZYNSKI, F., ALCAYDÉ, G., AMÉDRO, F., BADILLET, G., DAMOTTE, R., FOUCHER J. C., JARDINÉ, S., LEGOUX, O., MANIVIT, H., MONCIARDINI, C. et SORNAY, J. (1982): Le Turonien de la région-type: Saumurois et Touraine. Stratigraphie, biozonations, sédimentologie. — Bull. Centres Rech. Explor.-Prod. Elf-Aquitaine *6,* 119—225.

TSCHUDY, R. H. (1973): *Complexiopollis* Pollen Lineage in Mississippi Embayment Rocks. — Geol. Surv. Prof. Paper, Washington *743*-C, C1—C15.

3. BIOPOLYMER ORGANIZATION OF THE WALL OF THE FOSSIL SPORES AND POLLEN GRAINS

M. KEDVES[1] and I. KINCSEK[2]

1. Cell Biological and Evolutionary Micropaleontological Laboratory of the Department of Botany of the J. A. University, H–6701, P.O. Box 657, Szeged, Hungary, 2. Department of Biology, J. Gy. High School, H–6701, P.O. Box 396, Szeged, Hungary

Abstract

The transmission electronmicroscopical data of the laboratory prepared from 1969 on fossil spores and pollen grains were reinvestigated from the point of view of the degree of the degradation of the sporoderm. This work taxonomically includes the following: 23 form-species of *Pteridophyta* spores, 16 form-species of *Gymnospermatophyta,* and 75 form-species of *Angiospermatophyta* pollen grains. During the evaluation of the TEM data the following points of view were taken into consideration: Locality, geological age, embedding rock, resolution power of the used TEM instrument, presence of the basic biopolymer unit, highly organized globular units and the superficial biopolymer differentiations. The following was established: 1. The wall of the *Pteridophyta* spores is extremely resistant, 2. *Gymnospermatophyta* pollen grains are heterogeneous in this respect. The basic and highly organized biopolymer system was observed on the ectexine and endexine of *Balmeiopsis limbatus.* Saccate pollen grains are extremely resistant after a fossilization process. 3. The biopolymer systems of *Angiospermatophyta* pollen grains are much more complex in contrast to the previous ones. The exines of *Longaxones* pollen grains as the early types are more resistant than the more developed *Brevaxonate* ones. Typical regular pentagonal basic units and highly organized globules are simultaneously observed at the exines of *Thomsonipollis* and *Restioniidites* from the Eocene layers of the *Mississippi,* USA.

Key words: Palynology, fossil, transmission electron microscopy, biopolymer structure.

Introduction

Our transmission electronmicroscopical investigations on the fossil spores and pollen grains started in 1969, the first results appeared in 1970a, b (KEDVES and PÁRDUTZ). Several publications followed with the evaluation from the point of view of the ultrastructure phylogeny (e.g.: KEDVES, 1988a). A monographical elaboration of the TEM data was also planned. The first monography on the fossil angiosperm pollen grains appeared in 1990. The second ones about the fossil spores and gymnosperm pollen grains is just before completing the manuscript for publication.

In 1974 KEDVES, STANLEY and ROJIK published the macromolecular units of the partialy degraded exines of *Restioniidites hungaricus,* and *Thomsonipollis magnificus* from the Lower Eocene layers of Mississippi, USA. Later several experimental studies started on recent sporomorphs, with the aim to investigate the biopolymer structure of the sporoderm, with different kinds of methods.

The discovery of the quasi-crystalloid biopolymer structure of the sporoderm (KEDVES, 1988b) induced new directions of researches.

The biopolymer structure can be investigated by the TEM method on partially degraded biological structures. This partial degradation can be in vitro and natural, during the sedimentation process.

To get fundamental information about the fossil biopolymer structures it is necessary to evaluate and synthetize all the obtained fossil TEM data from the point of view of partial degradation and biopolymer structure. This is the aim of this contribution.

Methods

The sporomorphs investigated by the TEM method came from the following localities, and embedding rocks, in order to their geological age.

Jurassic

Liassic, Hungary, Úrkút, carbonaceous manganese ore; HU., J., Urk.
Egypt, Kharga Oasis, lower part of the Nubia Sandstone, carbonaceous clay; EG., J., Kh.
Egypt, Farafra Oasis, lower part of the Nubia Sandstone, clay; EG., J., Fa.

Cretaceous

Upper Cenomanian, Portugal, Vila Flor, carbonaceous clay; PORT., Cr., Vila F.
Upper Cenomanian – lower Turonian, Portugal, Fermentelos, carbonaceous clay; PORT., Cr., Fer.
Lower Turonian, Portugal, Carrajão, carbonaceous clay; PORT., Cr., Car.
Turonian, Portugal, Marmeleira do Botão, carbonaceous clay; PORT., Cr., M. do Bot.
– Portugal, Oia, dark bitumenous clay; PORT., Cr., Oia.
Santonian – Campanian, Portugal, Aveiro, carbonaceous clay; PORT., Cr., Av.
Upper Cretaceous, Hungary, Ajka, brown coal; HU., Cr., Aj.
Hungary, Herend, brown coal; HU., Cr., Her.
Maestrichtian, Egypt, Farafra Oasis, upper part of the Nubia Sandstone, carbonaceous clay; EG., Cr., Fa.
Maestrichtian, Kazakhstan, Bet-pak-dala; KAZ., Cr.

Eocene

Lower Eocene, USA, Mississippi, brown coal; USA, Eoc., Miss.
– France, Paris Basin, brown coal; FR., Eoc., P.B.
– Hungary, Úrkút, carbonaceous clay; HU., Eoc., Urk.
Middle Eocene, Hungary, Balinka, carbonaceous shale; HU., Eoc., Bal.
– Hungary, Oroszlány, brown coal; HU., Eoc., Or.
– Hungary, Zirc, black, slightly sandy clay; HU., Eoc., Zi.

Oligocene

Upper Oligocene, Hungary, Fehérvárcsurgó, carbonaceous clay; HU., Olig., Feh.

Results are summarized in the order of morphographical taxa. After the form-species name, the shortened data of the localities and geological ages are indicated. The resolution power in this respect is indicated with + or –, similarly the presence or absence of the different kinds of biopolymer structures; basic biopolymer unit, open polygon, superficial differentiations.

Results

SPORES

	resolution power	basic biopolymer unit	open polygon	superficial differentiations
Leiotriletes				
– *adriennis triplanoid*, HU., Eoc., Zi.	–	?	+	–
– *pseudodorogensis*, HU., Eoc., Zi.	–	?	+	–
– ex gr. *maxoides maximus*, PORT., Cr., Vila F.	+	+	+	–
– asp. *sinuosoides*, PORT., Cr., Vila F.	+	+	–	–
– *fsp.*, PORT., Cr., Vila F.	+	+	+	–
Undulatisporites				
– *undulapolus*, PORT., Cr., M. do Bot.	+	+	+	–
Dictyophyllidites				
– *eocaenicus*, HU., Eoc., Zi.	–	?	+	–
Paraconcavisporites				
– *nubiensis*, EG., J., Kh.	+	–	–	–
Saadisporites				
– *aegyptiaca*, EG., J., Kh.	+	–	+	+
Hydrosporis				
– *farafraensis*, EG., Cr., Fa.	+	–	–	–
Echinatisporis				
– cf. *fsp.*, EG., J., Fa.	+	–	+	–
Foveotriletes				
– *subtriangularis*, EG., Cr., Fa.	–	–	–	?
Vadaszisporites				
– *sacali*, EG., Cr., Fa.	–	–	+	–
Cicatricosisporites				
– *baconicus*, PORT., Cr., Vila F.	+	–	–	+
Zlivisporis				
– *blanensis*, EG., Cr., Fa.	+	±	–	–
Appendicisporites				
– *erdtmanii*, PORT., Cr., M. do Bot.	+	–	+	–
– *tricuspidatus*, HU., Cr., Her.	–	–	+	–
Ariadnaesporites				
– *lusitanicus*, PORT., Cr., Vila F.	+	–	–	–
Hymenoreticulisporites				
– *altimurornatus*, EG., J., Kh.	+	–	–	–
Polypodiaceoisporites				
– *fsp.*, PORT., Cr., Vila F.	+	–	–	–
Hamulatisporis				
– *insignis*, EG., Cr., Fa.	+	–	–	–
Microfoveolatosporis				
– *pseudodentatus*, HU., Eoc., Zi.	–	–	–	–
– *fsp.*, PORT., Cr., Vila F.	+	–	+	–

POLLEN GRAINS
Gymnosperms

	resolution power	basic biopolymer unit	open polygon	superficial differentiations
Pityosporites				
– *singularis*, PORT., Cr., Oia, M. do Bot., Vila F.	+	–	–	–
– *microalatus*, HU., Olig., Feh.	–	–	–	–
Parvisaccites				
– *radiatus*, PORT., Cr., Fer.	+	–	–	–
Inaperturopollenites				
– ex gr. *hiatus*, PORT., Cr., Fer.	+	+	–	–
Araucariacites				
– *balinkaense*, EG., Cr., Fa.	–	–	–	–
– *australis aegypticus*, EG., Cr., Fa.	–	–	+	–
– *hungaricus*, PORT., Cr., Oia.	+	+	–	–
Balmeiopsis				
– *limbatus*, EG., J., Fa.	+	+	–	–
Spheripollenites				
– *scabratus*, HU., J., Urk.	–	–	–	–
Classopollis				
– *classoides*, HU., J., Urk., EG., J., Kh.	+	+	–	–
– *minor*, EG., J., Kh.	+	+	+	–
Classoidites				
– *glandis*, PORT., Cr., Av.	–	–	–	–
Ephedripites				
– *virginiaensis*, EG., Cr., Fa.	–	–	–	–
– *multicostatus*, EG., Cr., Fa.	+	+	–	–
Cycadopites				
– *minimus*, HU., J., Urk.	+	–	–	–
– *fsp.*, PORT., Cr., Fer.	+	+	–	–

Angiosperms

Retimonocolpites				
– *granulatus*, HU., Eoc., Zi.	–	–	–	–
Liliacidites				
– *barakatii*, EG., Cr., Fa.	–	–	–	–
Transdanubiaepollenites				
– *magnus*, HU., Eoc., Urk.	–	–	–	–
Cupuliferoidaepollenites				
– cf. *quisqualis*, PORT., Cr., Av.	–	–	–	–
– *liblarensis*, HU., Eoc., Zi.	–	–	–	–
Polycolpites				
– *viesenensis*, HU., Eoc., Zi.	–	–	–	–
Betpakdalina				
– ex gr. *protuberantis*, KAZ., Cr.	–	–	–	–
– ex gr. *tetrabarbata*, KAZ., Cr.	–	–	–	–
– ex gr. *minuta*, KAZ., Cr.	–	–	–	–
Retitricolporites				
– cf. *microreticulatus*, FR., Eoc., P.B.	–	–	–	–

	resolution power	basic biopolymer unit	open polygon	superficial differentiations
Araliaceoipollenites				
— *euphorii,* HU., Eoc., Urk.	–	–	–	–
Nyssapollenites				
— *kruschii,* HU., Eoc., Urk.	–	–	–	–
Cupuliferoidaepollenites				
— *pusillus,* HU., Eoc., Urk.	–	–	–	–
Intrabaculitricolporites				
— *sooi,* HU., Eoc., Urk.	–	–	–	–
Granotricolporites				
— *semiglobosus,* HU., Eoc., Bal.	–	–	–	–
— *miniverrucatus,* FR., Eoc., P.B.	–	–	–	–
Ilexpollenites				
— *margaritatus medius,* FR., Eoc., P.B.	–	–	–	–
Striatricolporites				
— *solé de portai,* HU., Eoc., Zi.	–	–	–	–
Teixeraipollenites				
— *globosus,* PORT., Cr., Vila F.	–	–	–	–
Pentapollenites				
— *laevigatus,* HU., Eoc., Zi., Bal.	–	–	–	–
Bolchovitinaepollenites				
— *punctatus,* PORT., Cr., Vila F.	+	–	–	+
— *microreticulatus,* PORT., Cr., Vila F.	+	–	–	–
Samoilovichaepollenites				
— *concavus,* PORT., Cr., Vila F.	+	–	–	–
Vilaflorpollenites				
— *concavus,* PORT., Cr., Vila F.	+	–	–	–
— *magnus,* PORT., Cr., Vila F.	+	–	–	–
— *pflugii,* PORT., Cr., Vila F.	+	–	–	–
— *rugulatus,* PORT., Cr., Vila F.	+	–	–	–
— *ibericus,* PORT., Cr., Vila F.	+	–	–	–
— *minor,* PORT., Cr., Vila F.	+	–	–	–
Complexiopollis				
— *praeatumescens,* PORT., Cr., Car.	+	–	–	–
— *vancampoae,* PORT., Cr., Vila. F.	+	–	–	–
— *helmigii,* PORT., Cr., Vila. F.	+	–	–	–
Atlantopollis				
— *reticulata,* PORT., Cr., Fer., Car.	+	+	–	–
— *microreticulata,* PORT., Cr., Fer.	+	+	–	–
— *variabilis,* PORT., Cr., Vila F.	+	–	–	–
— *vilaflorensis,* PORT., Cr., Vila F.	+	–	–	–
— *microrugulata,* PORT., Cr., Vila F.	+	–	–	–
— — PORT., Cr., Fer.	+	+	–	–
— *grootii,* PORT., Cr., Fer.	+	+	–	–
— *choffatii,* PORT., Cr., Fer.	+	+	–	–
— *convexa,* PORT., Cr., Fer.	+	+	–	–
— *verrucosa,* PORT., Cr., Fer.	+	+	–	–
— *lusitanica,* PORT., Cr., Vila F.	+	–	–	–
Limaipollenites				
— *triangulus,* PORT., Cr., Vila F.	+	+	–	–

	resolution power	basic biopolymer unit	open polygon	superficial differentiations
— *vilaflorensis*, PORT., Cr., Vila F.	+	–	–	–
— *minor*, PORT., Cr., Vila F.	+	–	–	–
Trudopollis				
— *mechanicus*, HU., Cr., Her.	–	–	–	–
Pompeckjoidaepollenites				
— *subhercynicus*, FR., Eoc., P.B.	–	–	–	–
Oculopollis				
— *zaklinskaiae*, HU., Cr., Her.	–	–	–	–
— *minoris*, HU., Cr., Aj.	+	+	–	–
Semioculopollis				
— *praedicatus*, HU., Cr., Aj.	+	+	–	–
— *croxtonae*, HU., Cr., Her.	–	–	–	–
— *granulosus*, HU., Cr., Her.	–	–	–	–
Hungaropollis				
— *krutzschii*, HU., Cr., Her.	–	–	–	–
— cf. *medusii*, HU., Cr., Her.	–	–	–	–
Basopollis				
— *basalis*, FR., Eoc., P.B., USA, Eoc., Miss.	+	+	–	+
Nudopollis				
— *terminalis*, FR., Eoc., P.B., USA, Eoc., Miss.	+	+	–	+
Interporopollenites				
— *endotriangulus*, PORT., Cr., Av.	–	–	–	–
Plicapollis				
— *pseudoexcelsus turgidus*, FR., Eoc., P.B., USA, Eoc., Miss.	+	+	–	+
Vacuopollis				
— *orthopyramis*, PORT., Cr., Av.	–	–	–	–
Interpollis				
— *microsupplingensis*, USA., Eoc., Miss.	+	+	+	+
— *messelensis*, USA., Eoc., Miss.	+	+	–	+
Thomsonipollis				
— *magnificus*, USA., Eoc., Miss.	+	+	–	+
Labraferoidaepollenites				
— *rurensis*, HU., Olig., Feh.	–	–	–	–
Plicatopollis				
— *laevigatus*, HU., Eoc., Urk., Zi.	+	–	–	–
Triporopollenites				
— *robustus robustus*, Fr., Eoc., P.B., USA, Eoc., Miss.	+	+	–	+
— *pflugii*, HU., Eoc., Urk.	–	–	–	–
Subtriporopollenites				
— *constans constans*, HU., Eoc., Urk.	+	+	–	–
— *constans magnus* FR., Eoc., P.B.	–	–	–	–
Diporoconia				
— *iszkaszentgyoergyi*, HU., Eoc., Urk.	–	–	–	–
Kopekipollenites				
— *magnus*, HU., Eoc., Or.	–	–	–	–
Platycaryapollenites				
— *miocaenicus*, USA, Eoc., Miss.	+	+	–	+
Alnipollenites				
— *verus*, HU., Olig., Feh.	–	–	–	–

	resolution power	basic biopolymer unit	open polygon	superficial differentiations
Intratriporopollenites				
— *microreticulatus*, Fr., Eoc., P.B.	–	–	–	–
Caryapollenites				
— *triangulus*, USA., Eoc., Miss.	+	+	–	+
Compositoipollenites				
— *rhizophorus*, FR., Eoc., P.B.	–	–	–	–
Restioniidites				
— *hungaricus*, USA, Eoc., Miss.	+	+	–	+

Discussion and Conclusions

SPORES

On the basis of our up-to-date knowledge, the bituminous (dark) clay preserved the best the wall structure. Among the different kinds of biopolymer structures it is the open polygon which occurred as the most frequent in our material. Regarding the geological age, the spores extracted from the Upper Cenomanian layers are in the best preservation. The colour of the embedding rock was dark coloured (coaley or bituminous) and the locality is in Portugal. Basic biopolymer structures occured in 1.7 per cent, open polygons in 52.1%, superficial differences in 6.8% of the investigated material.

GYMNOSPERM POLLEN GRAINS

It is worth of mentioning that at the fossil gymnosperm pollen grains we have not observed superficial differences. To this fact it can be pointed out that during our experiments of the recent saccate gymnosperm pollen grains we have observed and described interesting biopolymer structures (e.g.: KEDVES and PÁRDUTZ, 1992).

The intercalated argillaceous layers of the Nubia Sandstone in Egypt are the best from the point of view of the preservation of the exines.

Basic biopolymer units were observed on Upper Cenomanian and Turonian sediments from Portugal, from the carbonate manganese ore layers of Úrkút, in Hungary (Liassic), and from the lower part of the Nubia Sandstone; Egypt, Jurassic.

Open polygon was observed on the exines extracted from the intercalated argilaceous layers of the Nubia Sandstone from Egypt. Both parts, the Jurassic and the Upper Cretaceous were succesful in this respect.

In resumé, at the investigated fossil gymnosperm exines basic biopolymer structures was observed at the 43.75%, open polygon structure at 12.5% of the totality of the material.

ANGIOSPERM POLLEN GRAINS

In this very interesting and heterogeneous group 55.4% of the investigated material was degraded during the sedimentation processes, in this way a remarkable quantity (44.59%) of the biopolymer system was discovered.

At the fossil material open polygon was not observed during our investigations.

As regards the problem of preservation, carbonaceous clay and brown coal were suitable.

The most important discovery in this respect was made on the Eocene layers of Mississippi, USA on the fossil exines of *Restioniidites hungaricus* and *Thomsonipollis magnificus* (Kedves, Stanley and Rojik, 1974). These observations were the first on the fossil biopolymer structures, and started several new directions of experimental researches on recent and fossil exines.

Finally we must emphasize that the problem investigated in the present contribution is the first attempt to survey an extremely multifactorial question. In this way several questions and problems can emerge. But we hope that this contribution will be useful future researches.

Acknowledgements

This work was supported by the grant OTKA 1/3, 104.

References

Kedves, M. (1988a): Trends and problems of the researches of fossil spores and pollen grains. — Ann. Univ. Sci. Budapestinensis de R.E. Nom., Sect. Geol. *28*, 169—175.

Kedves, M. (1988b): Quasi-crystalloid basic molecular structure of the sporoderm. — 7 Internat. Palynol. Congr. Brisbane, Abstracts, 82.

Kedves, M. (1990): Transmission electron microscopy of the fossil angiosperm exines. — Szeged.

Kedves, M. and Párdutz, Á. (1970a): Az ultrastruktúra vizsgálatok jelentősége fosszilis *Angiospermatophyta* pollenszemek fejlődéstani kérdéseinek megoldásában. — Bot. Közlem. *57*, 57—58.

Kedves, M. and Párdutz, Á. (1970b): Études palynologiques des couches du Tertiaire inférieur de la Région Parisienne VI. Ultrastructure de quelques pollens d'*Angiospermes* de l'Eocène inférieur (Sparnacien). — Pollen et Spores *12*, 553—575.

Kedves, M. and Párdutz, Á. (1992): Transmission electron microscopy of partially dissolved exines of different bisaccate gymnosperm pollen grains. In: Plant Cell Biology and Development *3*, ed.: M. Kedves, 38—66, Szeged.

4. HIGH TEMPERATURE EFFECT ON THE SPORES OF USTILAGO MAYDIS (DE CANDOLLE) CORDA

M. KEDVES and A. TÓTH

Cell Biological and Evolutionary Micropaleontological Laboratory of the Department of Botany of the J. A. University, H-6701, P. O. Box 657, Szeged, Hungary

Abstract

This paper summarizes the first results about the experimental studies of the teliospores of *Ustilago maydis*. The high temperature effect to the spores was investigated in detail with the LM method. Temperature: 200 °C, length of time from 10′ until 300 hrs. On the basis of the first results we have established as follows. 1. During the heating of the teliospores the outer sculptured part of the wall is destroyed. This starts after 10 hours' heating, and is extremely advanced at the length of time of 100 hours. 2. The outermost wall layers lost spores, mounted in glycerine-jelly form interesting patterns, which are very useful in the modelling of the biopolymer structures of the partially degraded plant cell wall. 3. As regards the variation-statistical graphs of the diameter of the spores, several anomalies were observed. Some of them are in connection with the degradation of the wall, but there are also problems to be solved in the future.

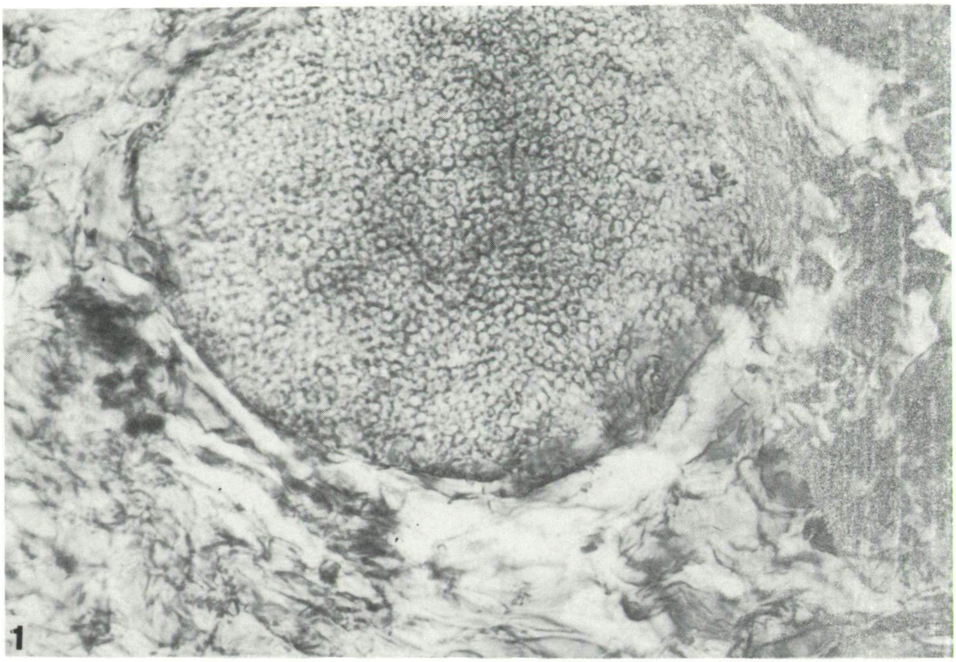
Key words: Palynology, recent, *Ustilago,* high temperature effect.

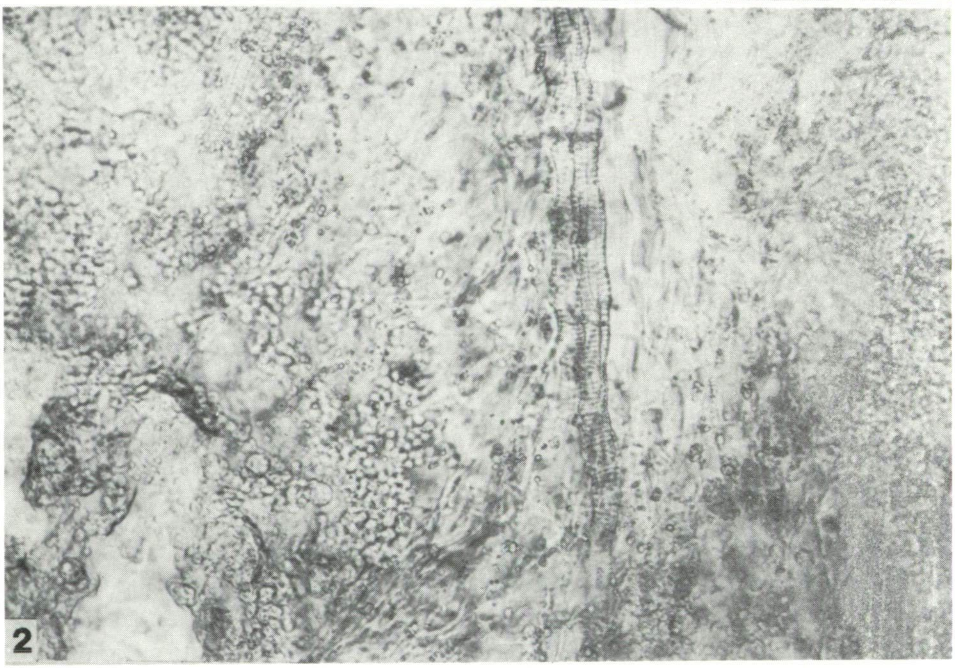
Introduction

In the last years the research program of the laboratory has changed and been completed with the new fields of researches. From the new fields several papers were also published; nearly from the biopolymer organization and symmetry of the plant cell wall, and about the experimental investigations on the spores and pollen grains. Until this time mostly spores of *Pteridophyta* and pollen grains *(Gymnospermatophyta, Angiospermatophyta)* were the subject of our experimental studies. But the extremely resistant wall of the spores and cysts of the parasitical microorganisms was also planned with the biopolymer structure of the animal cyst shells and cuticles. This paper presents the first results on this subject of the laboratory.

Plate 4.1. ▶

1,2. *Ustilago maydis* (DE CANDOLLE) CORDA, Recent.
LM pictures from sections of infected corn of mayze. 250x.
1. Spore ball in the infected corn.
2. General aspect from the infected corn tissue with parenchymatous and tracheary (secondary wood) elements.


1


2

Materials and Methods

The investigated material was collected by Dr. A. PALÁGYI on 22. 8. 1991. Locality: Ságvári Experimental Research Station of the Cereal Research Institute. The spores were frozen at – 20 °C after collection. The high temperature effect at 200 °C on the air dried spores was made as follows.

Length of time	Experiment No
0′	1192
10′	1193
1^h	1194
5^h	1195
10^h	1196
25^h	1197
50^h	1198
100^h	1199
200^h	1200
300^h	1201

The slides for light-microscopical investigations were mounted in glycerine-jelly hydrated at 39.6%. 200 specimens of each sample were investigated. To get a general aspect about the anatomy of the infected tissues of the corn of maize sections for LM investigations were made (by Mr. L. TÓTH–SOMA). The thin sections were stained with Safranine T, Bismarck Brown, and Toluidine blue and investigated with the LM method. The pictures were taken with an objective Carl Zeiss Jena, GH Planachromat 40X/0.65/0.17-A, (Plate 4.1., fig. 1,2), respectively with an objective of oil immersion Carl Zeiss Jena, GF Planachromat HI 100X/1.25/0.17-A (Plate 4.2. – plate 4–5.).

Halfthin and ultrathin sections were also made for TEM investigations. At this moment the aim of these preliminary studies was to get a basis for the fine structure and ornamentation of the wall. The transmission electron microscopy of the partially degraded spore wall and the investigation of the biopolymer system will be the subject of further investigations.

As regards the nomenclature and the previous data about the spores of *Ustilago maydis* (DE CANDOLLE) CORDA as basic works the following monographs were used: BÁNHEGYI, TÓTH, UBRIZSY and VÖRÖS (1985), VÁNKY (1985). As regards the LM measurements interesting methods by KÖHLER, 1933 and MECKE 1920 were published in the monograph of ERDTMAN (1954). SEM data: cf. VÁNKY, p. 222, Fig. 213 bis. Morphology of the fresh spores after the work of VÁNKI (1985), p. 222: "Spores globose, subglobose, ovoid to sometimes elongated or slightly irregular, 7–11×7–13 µm, light olive-brown; wall c. 0.5 µm thick, finely, rather densely echinulate. Germination by four-celled promycelium laterally and terminally bearing basidiospores."

Results

1. HISTOLOGY OF THE INFECTED CORN OF MAIZE (Plate 4.1., figs. 1,2, plate 4.2.)

These investigations are of a character of orientation. Illustrated are the not completely mature *Ustilago maydis* teliospores in the blasted corn. The delimination of the spore ball and the altered cells of the parenchymatous tissues (Plate 4.1., fig. 1, plate 4.2.) are well shown. In Plate 4.2. the small size and the hexagonal ambitus of the immature spores are illustrated. Picture 2 (Plate 4.1.) illustrates the dispersion of the infection with secondary xylem elements, tracheas.

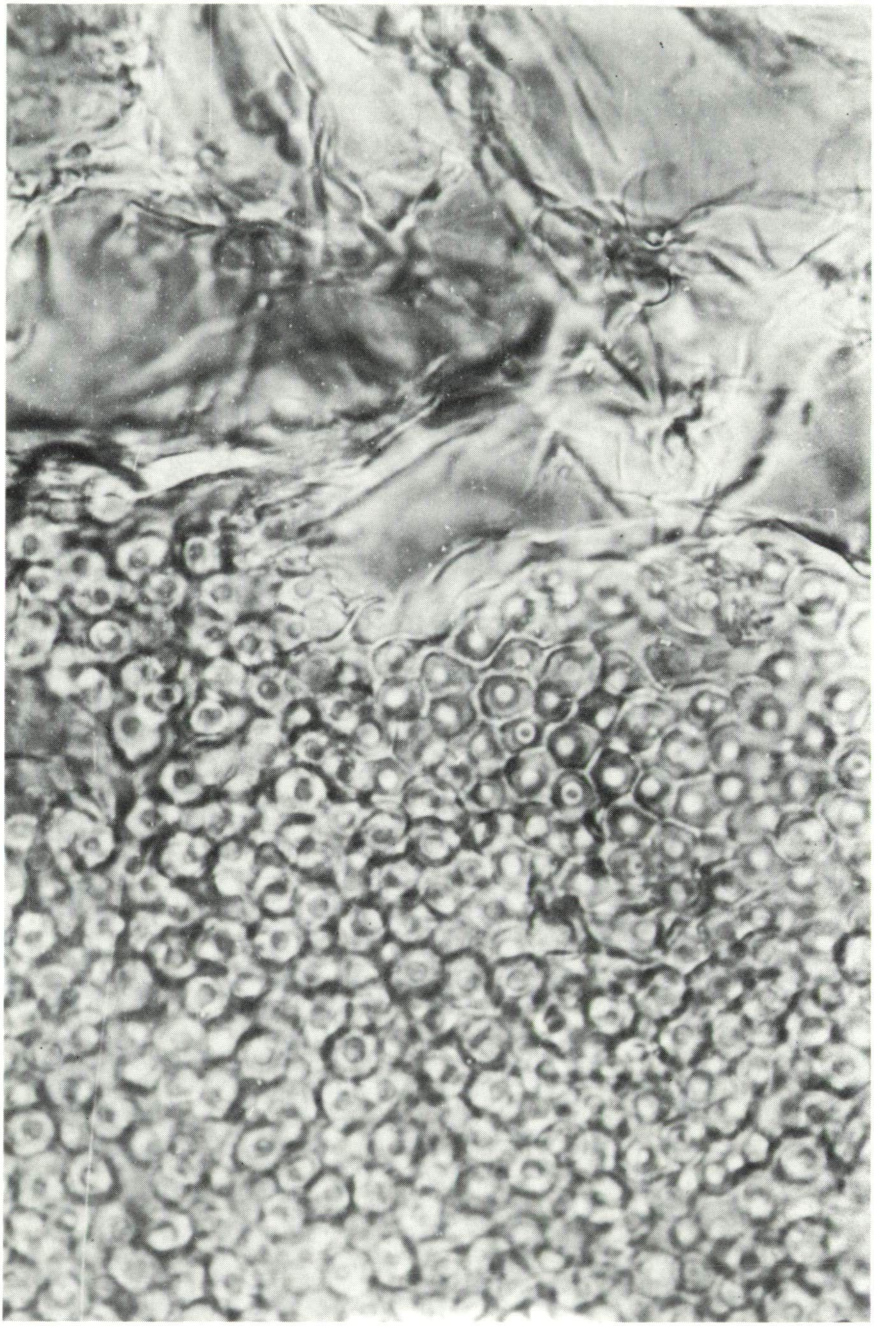
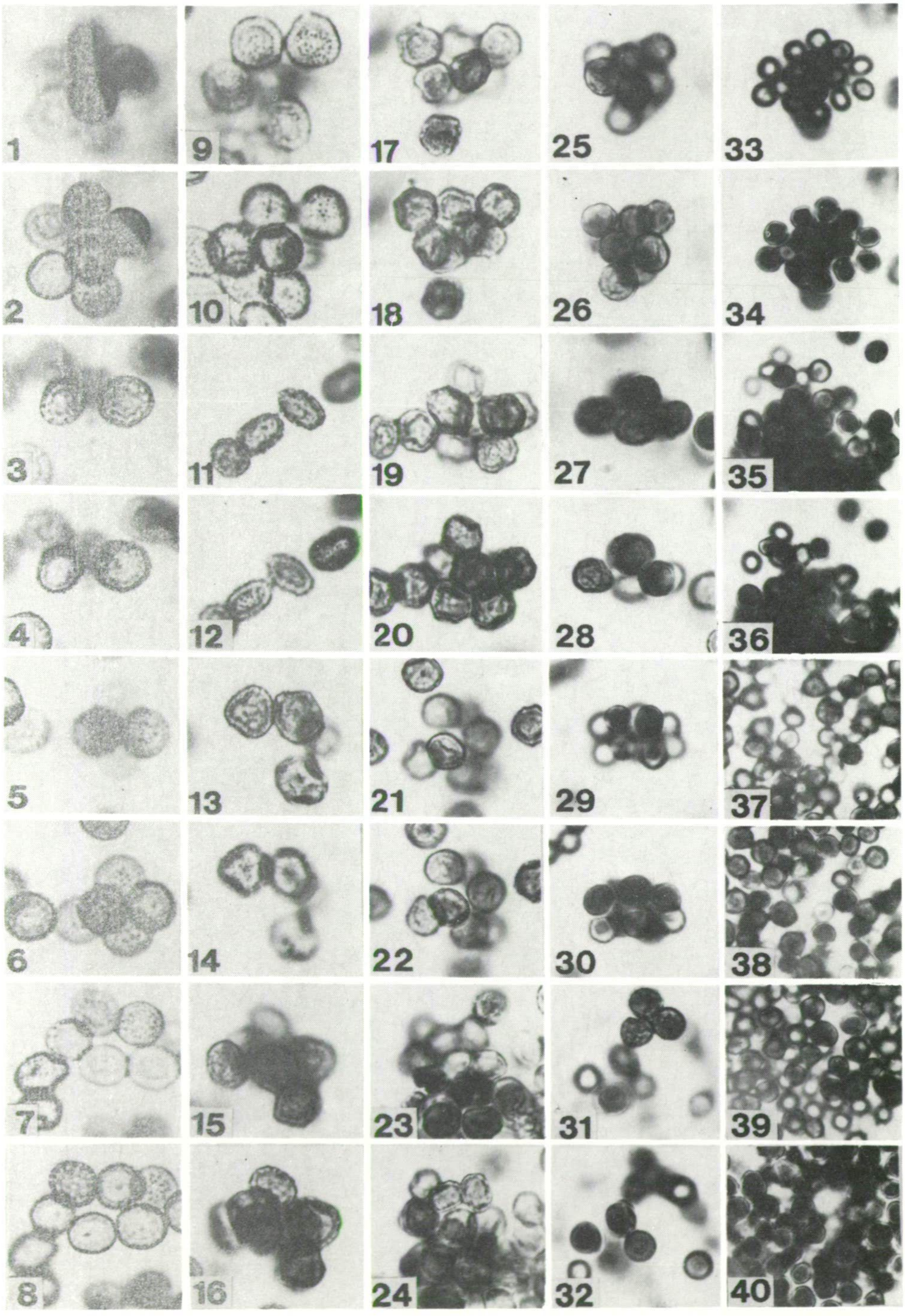


Plate 4.2.

Ustilago maydis (DE CANDOLLE) CORDA, Recent.
LM picture from the detail of the bordering of the spore ball in the parenchymatous tissue. The angular ambitus of the immature spores is characteristic. 1000×.


1 9 17 25 33
2 10 18 26 34
3 11 19 27 35
4 12 20 28 36
5 13 21 29 37
6 14 22 30 38
7 15 23 31 39
8 16 24 32 40

◀ Plate 4.3.

1—40. *Ustilago maydis* (DE CANDOLLE) CORDA, Recent.
1—4. Spores without staining or heating. Experiment No 1192.
5—8. Experiment No 1193, length of time 10′.
9—12. Experiment No 1194, length of time 1 hr.
13—16. Experiment No 1195, length of time 5 hrs.
17—20. Experiment No 1196, length of time 10 hrs.
21—24. Experiment No 1197, length of time 25 hrs.
25—28. Experiment No 1198, length of time 50 hrs.
29—32. Experiment No 1199, length of time 100 hrs.
33—36. Experiment No 1200, length of time 200 hrs.
37—40. Experiment No 1201, length of time 300 hrs.
1000×.

2. THERMAL ALTERATIONS OF THE MATURE TELIOSPORES (Plate 4.3., figs. 1—40, plate 4.4 figs. 1—3, plate 4.5., figs. 1—7, text-figs. 4.1., 4.2., and 4.3.)

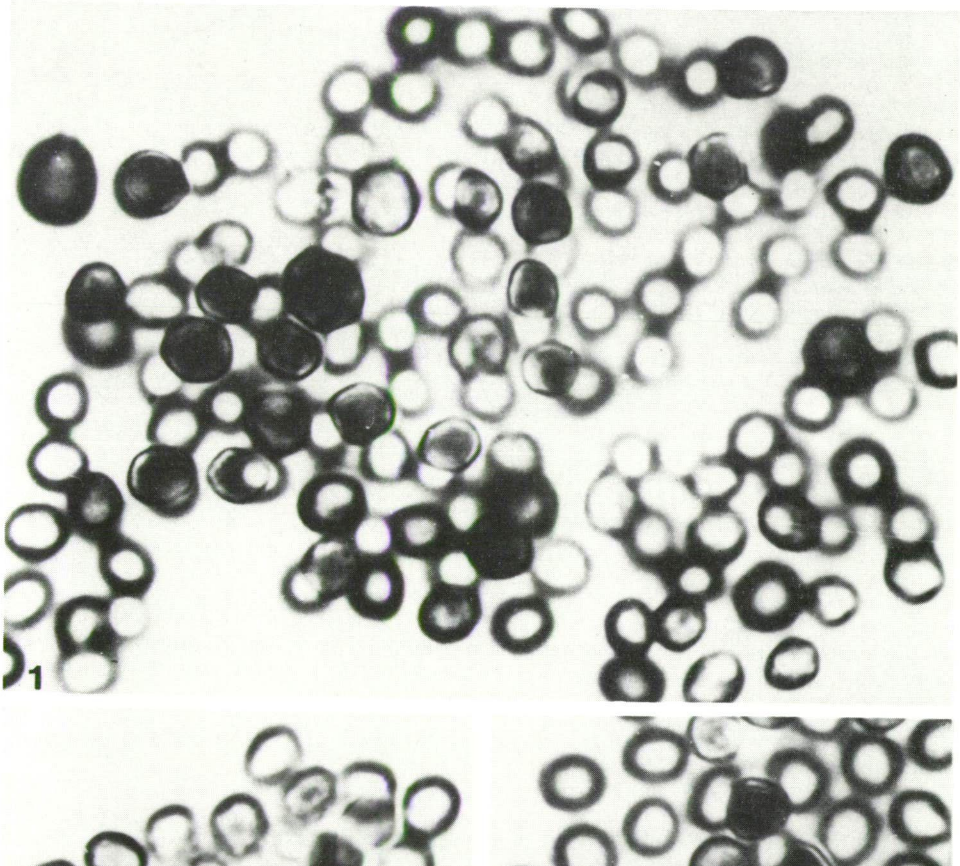
As regards the general morphology of the mature spores, our observations are concordant with the description of VÁNKY (1985, p. 222), mentioned previously.

2.1. *Qualitative alterations of the spores in consequence of the high temperature* (Plate 4.3., figs. 1—40)

Two important degrees of the secondary alterations can be established on the basis of the spore wall structure;
i. alterations with a complete spore wall,
ii. alterations of the outer wall lost spores.
At the first step of alteration the shape is in some cases elongated (Plate 4.3., figs. 11,12), and the ambitus can be newly hexagonal, a little similar to the immature spores (Plate 4.3., figs. 13—20). After 10 hours of heating at 200 °C the destruction of the spore wall starts. Parallel to this alteration the secondarily smooth (non sculptured) spores have newly globular or nearly globular form. These are interesting and unusual, in contrast to the previous ones. The most important characteristic features and results can be summarize as follows.

1. In Plate 4.3., figs. 27—40 and particular in the pictures of Plate 4.4. and 4.5. it is well shown that there are two kinds of spores. The darker are a little larger than the light coloured ones.

2. The arrangement of this kind of spores after mounting in glycerine-jelly is interesting, and these patterns seem to be useful to understand the space arrangement of the biopolymer structures, in particular of the quasi-crystalloid and quasi-equivalent systems.


1
2
3

◄ Plate 4.4.

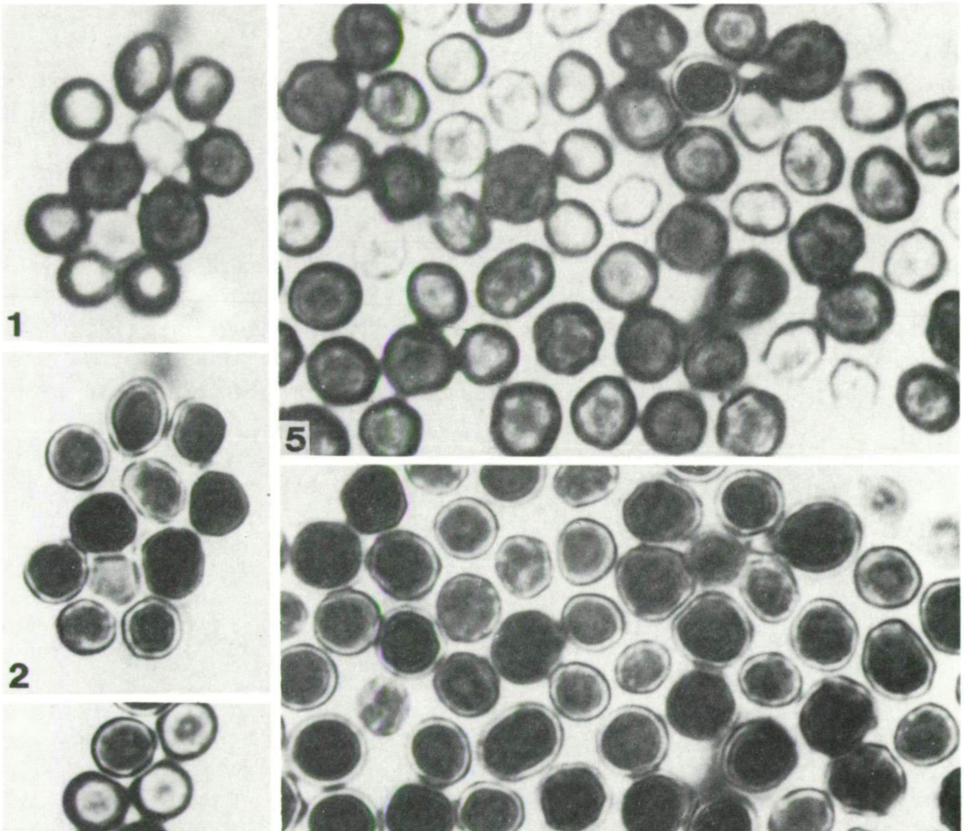
1—3. *Ustilago maydis* (DE CANDOLLE) CORDA, Recent.
Experiment No 1201, outer sculptured wall-layer lost spores mounted in glycerine-jelly, forming interesting patterns. 2.500×.

Linear arrangement. — The outer-layer lost globular spores can be arranged into one or two lines. The one cell composed lines can be divided. 64°, 70° and 90° were measured as angle of the bifurcate line (Plate 4.4., fig. 1). Alternating arrangements have been observed at the spore pattern of two lines (Plate 4.5., fig. 3,4).
Pentagonal and hexagonal arrangements of this kind of spores were also observed (Plate 4.4, fig. 2). Particularly interesting pentagonal "spore modell" can be seen in picture 3. Plate 4.4. The connection of the regular pentagonal arrangement with a hexagonal one (Plate 4.5., fig. 1,2) is a part of the model of the quasi-equivalent system.
Text-fig. 4.1., and 4.2. summarize the schemas which were made from the LM pictures of these spores.

2.2. *Quantitative alterations of the spores in consequence of the high temperature* (Plate 4.3., figs. 1—40, text-fig. 4.3.)

The variation-statistical graph of the intact spores is peculiar (Text-fig. 4.3., A, B,). 10′ and 1^h of heating resulted nearly the same graph with maximum. The graph of the spores heated for 5 hours is almost the mirror image of those of the intact spores. The proportions of the diameter of the spores heated for 10 hours are extremely interesting. The variation-statistical graph of the spores heated for 25 and 50 hours represents well the regular diminution in size of the spores. In contrast to this the variation-statistical graph of the spores heated for 100 hours is different and the most interesting. Namely this graph forms a regular shape of "V" with the graph of the intact spores. This can be taken as an extreme dislocation of the variation-statistical graphs of the non-experimental and experimental spores. The spores heated for 200 and 300 hours resulted in nearly the same diminution. It is noteworthy that the maximum size (7.5 μm) is identical with the smallest spores of the non experimental spores and those of heated for 10′, 1 hour 5, and 10 hours.

The ratio of the longest and smallest size (Text-fig. 5.3., C, D) represents approximatively regular alterations. Extreme graphs such as pointed out previously cannot be stressed.


1
2
3
4
5
6
7

◀ Plate 4.5.

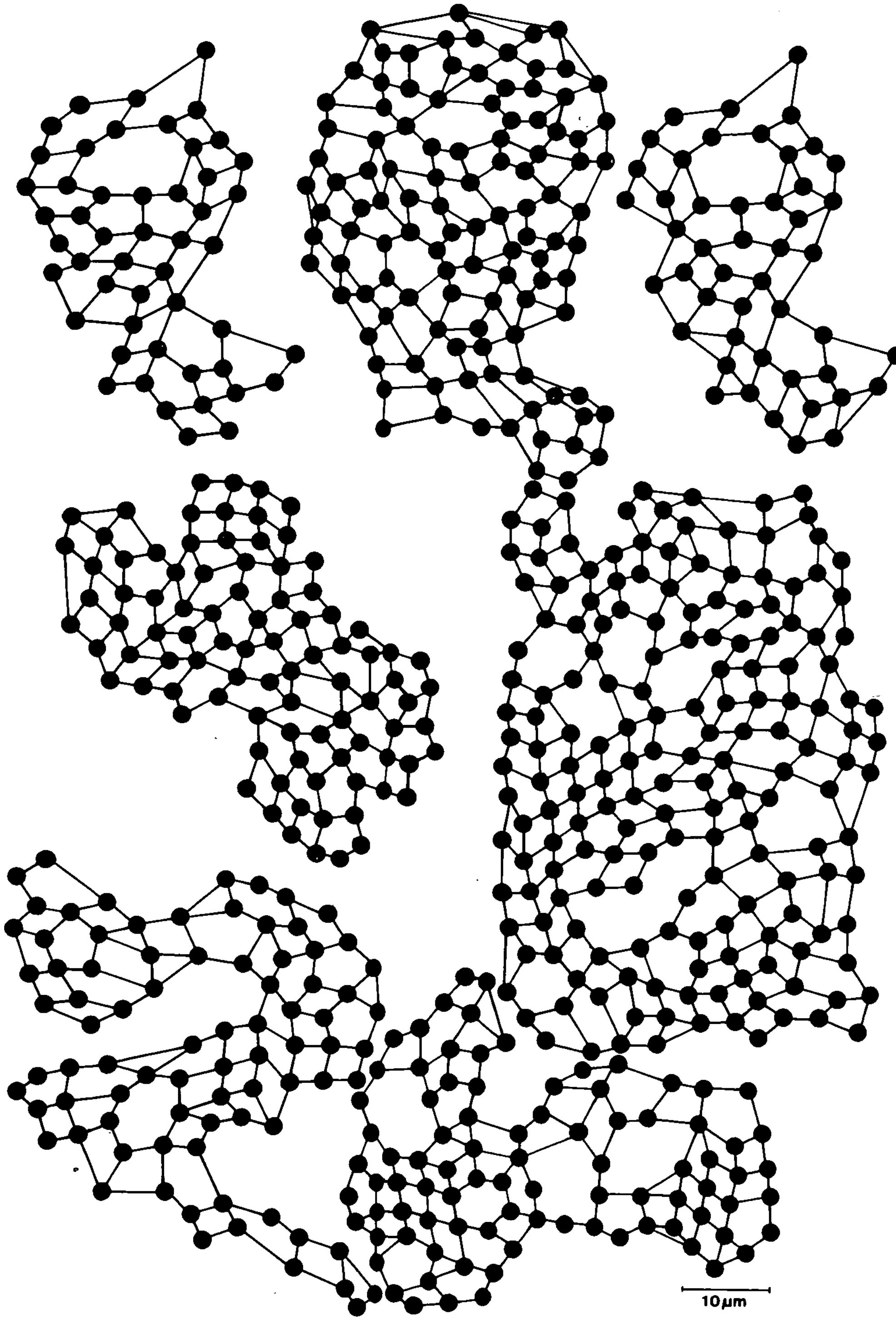
1–7. *Ustilago maydis* (DE CANDOLLE) CORDA, Recent.
Experiment No 1201, outer sculptured wall-layer lost spores mounted in glycerine-jelly, forming interesting patterns. 2.500×.

1,2. Pentagonal, and hexagonal arrangement.

3,4. Pentagonal arrangement connected with alternate linearly aligned spores.

5,6. General aspect of the spore pattern. The heterogeneous character of these spores, the darker and larger, and the light-coloured smaller ones are shown well.

7. A part of the massula of spores of different kinds of arrangement.


10μm

◀ Text-fig. 4.1.

Schemas made from the LM pictures of the pattern of the arrangement of the spores after experiment No 1201.

Discussion and Conclusions

1. It is necessary to emphasize that the results, presented in this paper represent our first attempts in this field. We hope that this will be followed by several further ones.

2. The "anomalies" in the variation-statistical graphs, particulary in the largest diameter of the spores must be later investigated as well. The degradation of the outer spore wall layers starts approximatively after 10 hours of heating. But it seems that this fact cannot explain the peculiarity of this variation-statistical graph. But the most interesting, and important anomaly of the variation-statistical graph was observed at spores heated for 100 hours. This is all probability in connection with the extremely advanced degradation of the outest sculptured layers of the spore wall.

3. The peculiar arrangement and the pattern of the outer wall layer lost spores can be taken as a peculiar kind of modelling of the biopolymer structures, composed from globular basic units.

4. There are some similarities between the sculptural layer lost teliospores and some fossil forms observed and illustrated in the sediments, in particular in the metamorphic layers.

Acknowledgements

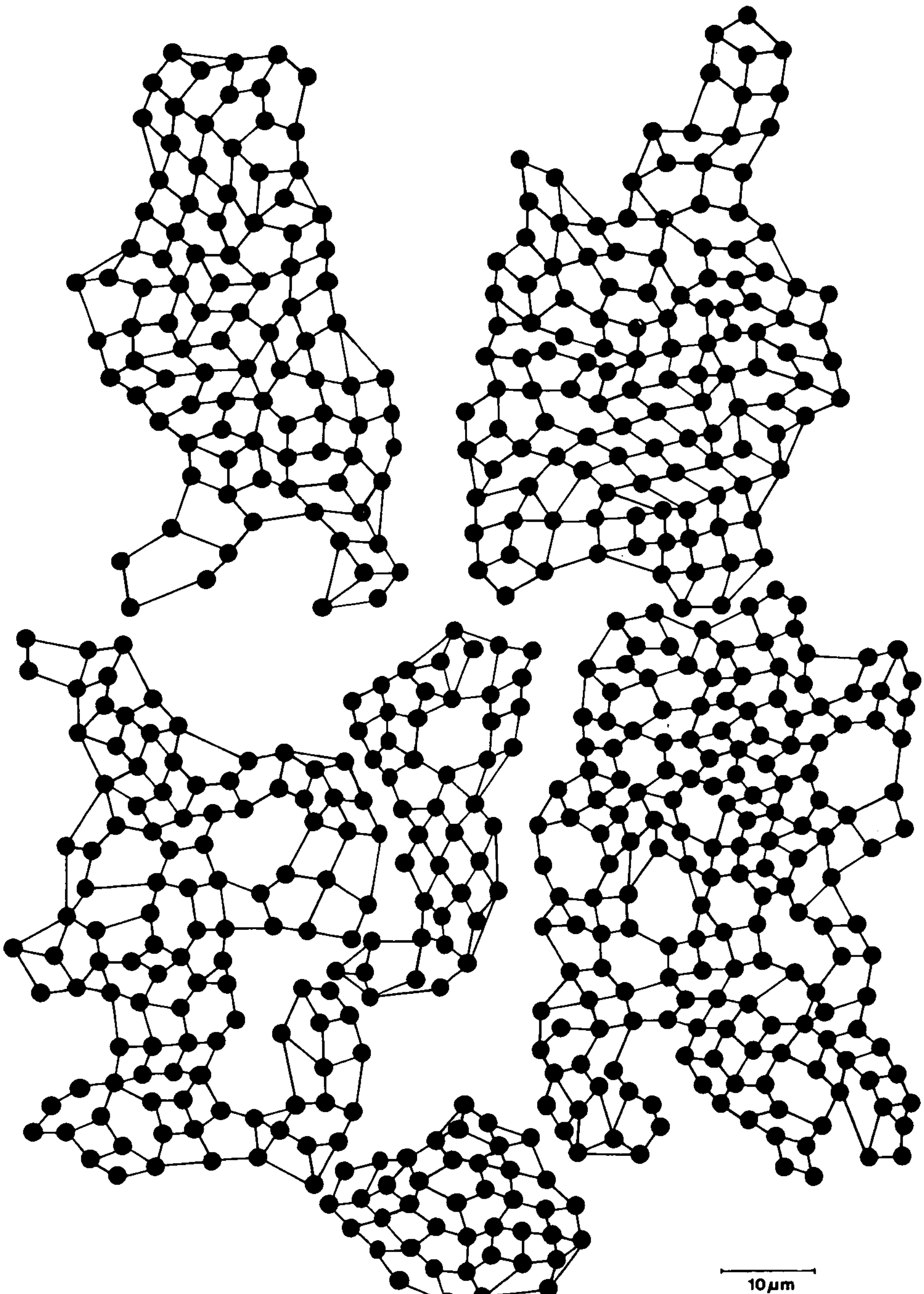
This work was supported by the grant OTKA 1/3, 104. The authors are deeply indebted to Mr. L. Tóth—Soma for preparing the sections for LM investigation from the infected corn of mayze.

References

Bánhegyi, J., Tóth, S., Ubrizsy, G. and Vörös, J. (1985): Magyarország mikroszkópos gombáinak határozókönyve 2. kötet *Eumycotina (Ascomycetes:* A *Discomycetes*től, *Basidiomycetes, Deuteromycetes)*. — Akadémiai Kiadó, Budapest.

Erdtman, G. (1954): An Introduction to Pollen Analysis. — Almqvist and Wiksell, Stockholm.

Vánky, K. (1985): Carpathian *Ustilaginales*. — Acta Univ. Upsaliensis, Symbolae Botanicae Upsaliensis *24*, 1—309.



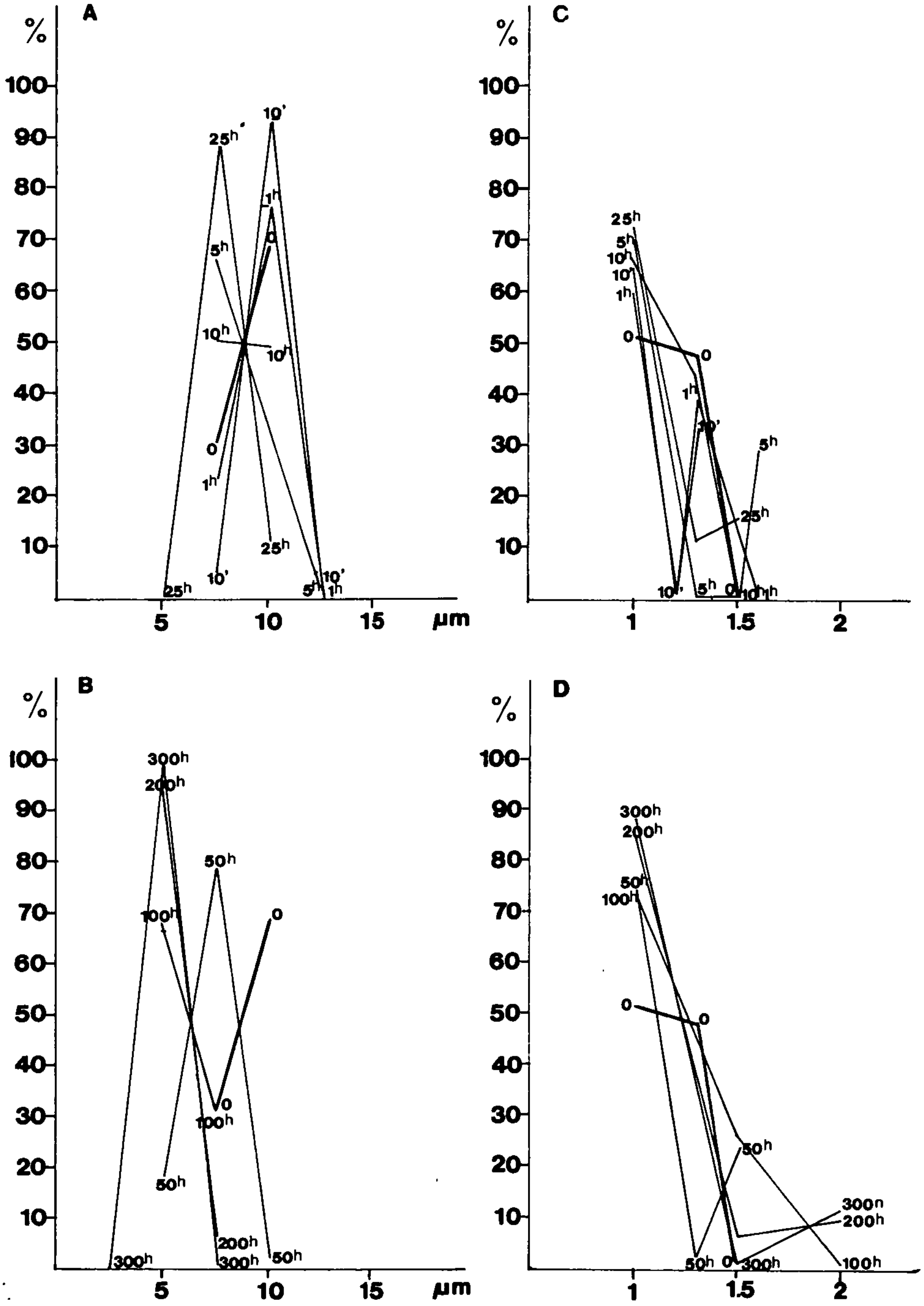
Text-fig. 4.2.

Schemas made from the LM pictures of the pattern of the arrangement of the spores after experiment No 1201.

Text-fig. 4.3. ▶

A,B. Variation-statistical graphs of the alternations of the maximum diameter of the spores in consequence of high temperature. The numbers at the graphs indicate the length of times of heating at 200 °C.

C,D. Variation-statistical graphs of the alternation of the longest and smallest diameter of the spores.


A
B
C
D
%
100
90
80
70
60
50
40
30
20
10
5
10
15
µm
1
1.5
2
25h
10'
1h
5h
0
10h
300h
200h
50h
100h

5. BIOPOLYMER ORGANIZATION OF THE EXINE OF JUNIPERUS VIRGINIANA L., AND TAXUS BACCATA L.

M. KEDVES[1] and I. ROJIK[2]

1. Cell Biological and Evolutionary Micropaleontological Laboratory of the Department of Botany of the J. A. University, H–6701, P.O. Box 657, Szeged, Hungary, 2. Faculty of Sciences, Laboratory of Electron-microscopy, P.O. Box 553, Szeged, Hungary

Abstract

Pollen grains of *Juniperus virginiana* L. and *Taxus baccata* L. were partially degraded with five different combination of solvents and oxidizing agents. These experiments were used following two basic methods: 1. Without heating before the solvent and oxidizing procedure. 2. The pollen grains were heated at 100 °C for one hour before the partial degradation. The solvated exines were fragmented with a magnetic stirrer in watered medium, for 30 minutes. With the transmission electron microscope several kinds of organization levels were observed, such as basic regular pentagonal polygons, PENROSE-like units, and their highly organized structures.

Key words: Palynology, *Gymnospermae*, inaperturate types, biopolymer structure.

Introduction

In our previous paper (KEDVES and ROJIK, 1989) partially degraded pollen grains of *Alnus glutinosa* (L.) GAERTN. were fragmented before the TEM studies. The advantages and the disadvantages of this combined method are pointed out in this paper. The fragmentation method of the partially degraded sclereids of *Armeniaca vulgaris* LAM. (KEDVES and ROJIK, 1991), and at the colonies of *Botryococcus braunii* KÜTZ, from the oil shale (KEDVES et al., 1991) resulted in surprising and interesting biopolymer structures. The finding of the basic pentagonal polygon biopolymer units and their highly organized PENROSE-I like structures in the sclereids of the endocarpium of *Armeniaca vulgaris* LAM. yields another opportunity to continue experiments for a new energy basis based on the energy which may be liberated during the disintegration of the biologic quasi-crystalloid biopolymer structures. Sclereids, and the *Botryococcus* colonies of the oil shale seem to be the most suitable for this purpose. But it is necessary to call attention to researches of the explosive dangerous coal pulver, and in general to the coal investigations, too. Two important purposes may be pointed out here:

I. The elimination or the diminution of the danger of explosion of the coal pulver in mines.

II. To try to utilize the energy of the explosion of the coal pulver.

In this paper, the results of two inaperturate gymnosperm pollen grains are summarized. The purpose of these investigations is to get a progress in the knowledge of the biopolymer structure of the gymnosperm pollen grains.

Materials and Methods

Juniperus virginiana L.

Collected: Dr. I. KINCSEK in the Botanical Garden of J. A. University on 10. 3. 1989.
Experiment numbers: 503-512.

Taxus baccata L.

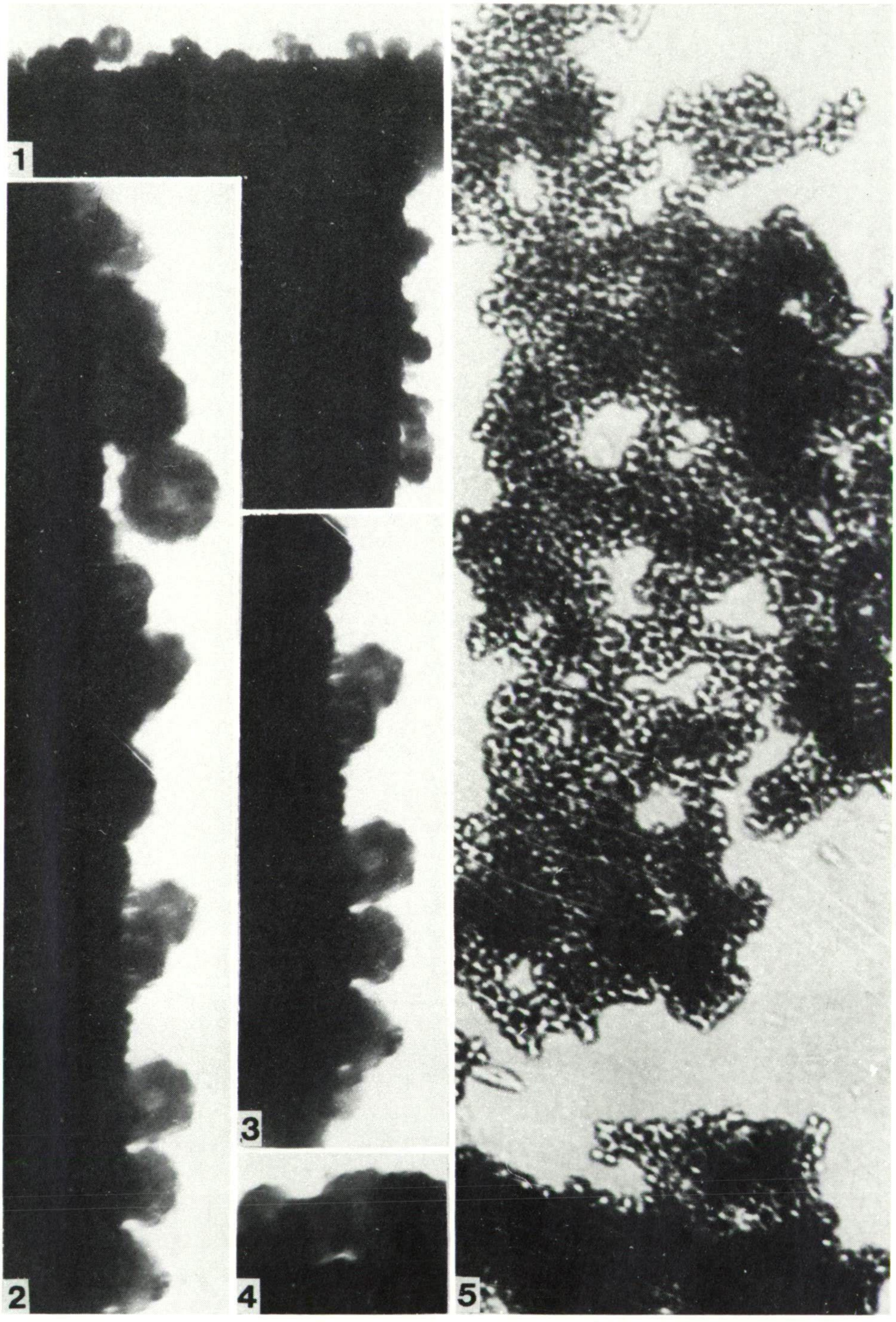
Collected: A. BARTOS in the Garden of the University building on 13. 3. 1989.
Experiment numbers: 513-521.

EXPERIMENTS

The experiments were made between 16. 3. 1989. – 21. 3. 1989.

Experiment numbers		
without heating	heated on °C 100 during 1^h	
503, 513	508, 518	20 mg air dried pollen grains + 1 ml 2-aminoethanol, temperature 30 °C, length of time 24^h
504, 514	509, 519	20 mg air dried pollen grains + 1 ml 2-aminoethanol, temperature 30 °C, length of time 24^h, washing (H_2O) + 10 ml 1% $KMnO_4$ aq. dil., temperature 30 °C, lenght of time 24^h
505, 515	510, 520	20 mg air dried pollen grains + 1 ml 2-aminoethanol, temperature 30 °C, length of time 24^h, washing (H_2O) + 10 ml $KMnO_4$ aq. dil., temperature 30 °C, length of time 48^h
506, 516	511, 521	20 mg air dried pollen grains + 1 ml 2-aminoethanol, temperature 30 °C, length of time 24^h, washing (H_2O) + 10 ml 1% $KMnO_4$ aq. dil., temperature 30 °C, length of time 24^h, washing (H_2O) + 2 ml acetic acid anhydride, temperature 30 °C, length of time 24^h
507, 517	512, 522	20 mg air dried pollen grains + 1 ml 2-aminoethanol, temperature 30 °C, length of time 24^h, washing (H_2O) + 10 ml 1% $KMnO_4$ aq. dil., temperature 30 °C, length of time 24^h, washing (H_2O) + 5 ml methanol, temperature 30 °C, length of time 24^h

The following process is identical with those published in our previous paper (1989), p. 72: "After the partial degradation of the pollen grains the residues were washed in distilled water. The fragmentation was made with a magnetic stirrer in watered medium, during 30 minutes. The fragmented exines were dropped on a grid covered with collodium pellicle and then dried. The electron microscopical investigations were made on a Tesla BS-500 transmission electron microscope, resolution 6 Å."



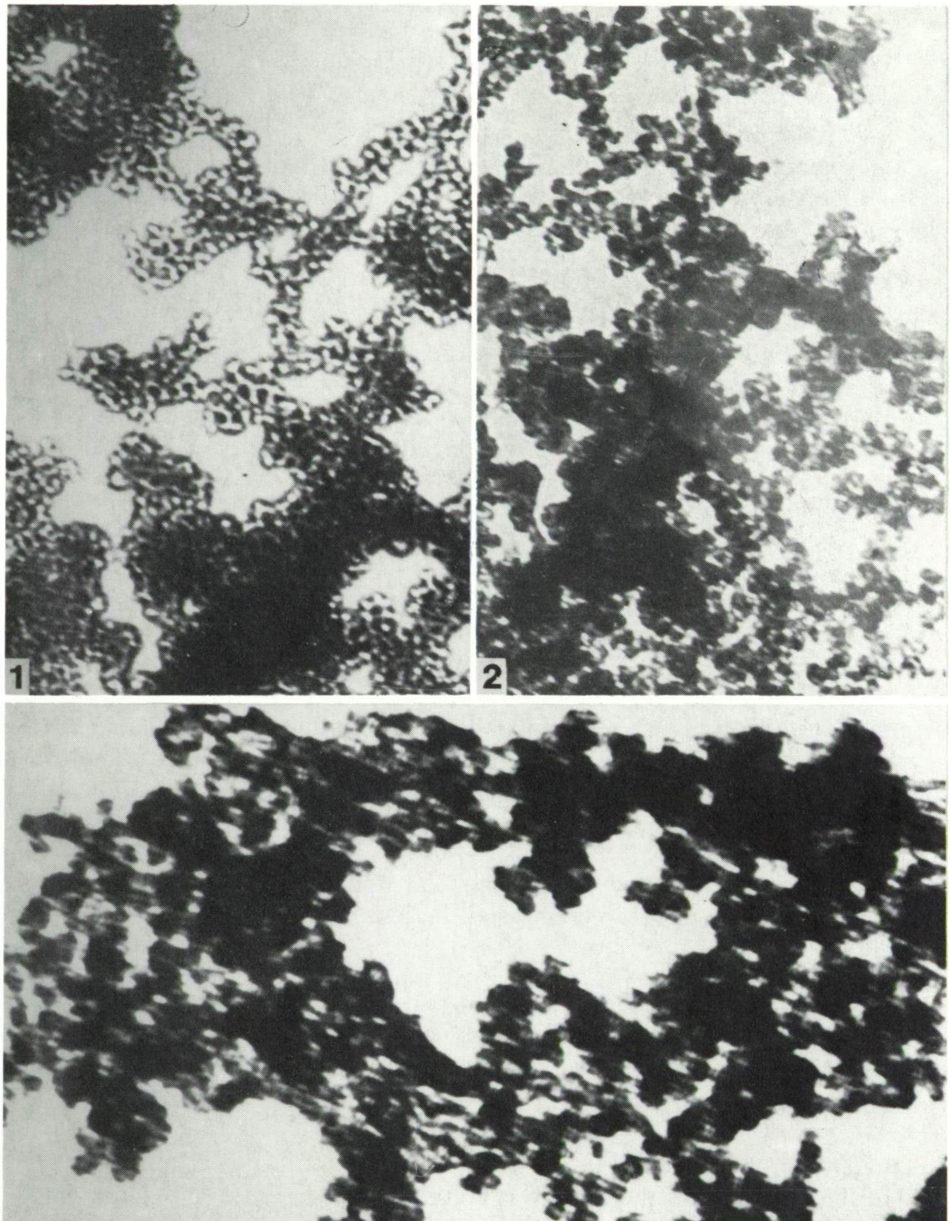
◄ Plate 5.1.

1—5. *Juniperus virginiana L.*

1—4. Experiment No: 503, outer surface of the pollen grain, covered with orbiculi.
1. Negative no: 9171, 20.000x.
2—4. Negative no: 9171, 50.000x.
5. Experiment No: 504, characteristic biopolymer structure of different organization levels. Negative no: 9182, 250.000x.

Plate 5.2. ►

1—3. *Juniperus virginiana L.*
1,2. Experiment No: 505, two kinds of biopolymer structure preservation. Negative no: 9186, 250.000x.
3. Experiment No: 506, biopolymer structure of the pollen wall. Negative no: 9296, 100.000x.


1
2
3

Results

Juniperus virginiana L.

Experiment No: 503 (Plate 5.1., figs. 1–4)

This experiment has not sufficiently degraded the exine to the investigation of the biopolymer organization of the exine. The orbiculi on the surface of the pollen grain are illustrated. Inside the orbiculi no molecular structure was observed.

Experiment No: 504 (Plate 5.1., fig. 5)

Well defined biopolymer structures were observed. These molecular systems are of different organization levels. Light polygons of 8–16 Å in diameter with central globular elements of strong electron density are the basic regular pentagonal polygon units. The diameter of the highly organized PENROSE-I like, nearly globular units is 26–38 Å. These units are arranged into filaments and/or larger mostly irregular polygon systems.

Experiment No: 505 (Plate 5.2., fig. 1,2)

Regarding the fine organization and the electron density of the particles, two kinds of biopolymer structures were observed. One is similar to the previously discussed one (Plate 5.2., fig. 1). But the basic biopolymer units are mostly arranged into filaments. The filamental units are arranged into irregular larger polygons. The second type of biopolymer structure illustrated in Plate 5.2., fig. 2., is composed of electron dense globular units which may occur of different kinds of high organization.

Experiment No: 506 (Plate 5.2., fig. 3)

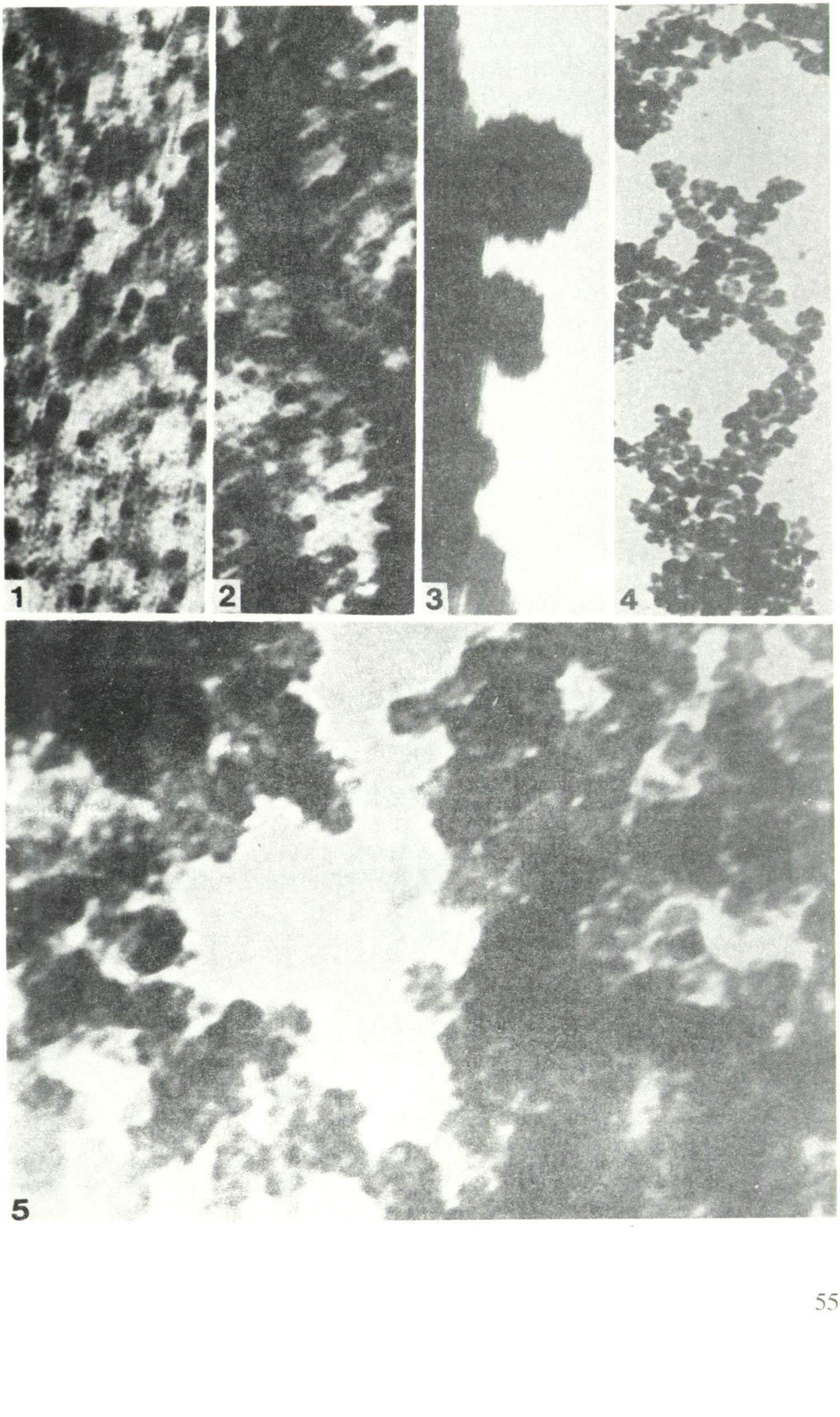
This experiment resulted in dark globular units of 15–30 Å. The arrangement of these units is not so regular as at the previous experiment.

Experiment No: 507 (Plate 5.3., fig. 1,2)

In consequence of this kind of experiment light – negative – regular basic pentagonal units were observed together with the electron dense network of pentagon biopolymer system. In general an advanced degradation may be established in the biopolymer system.

Experiment No: 508 (Plate 5.3., fig. 3,4)

The TEM picture of the surface is a little similar to those of experiment No 503. As difference the more compact consistence of the exine and the orbiculi can be pointed out. This is in all probability in consequence of heating before the partial degradation with the solvent method. Fig. 3. of Plate 5.3. illustrate the surface of the pollen grain with orbiculi. But together with the above mentioned fragments globular biopolymer structures were also observed (Plate 5.3., fig. 4). The diameter of these globular units is about 14–25 Å, the electron affinity is on a high level. The arrangment (linear and/or network-like) can be pointed out.

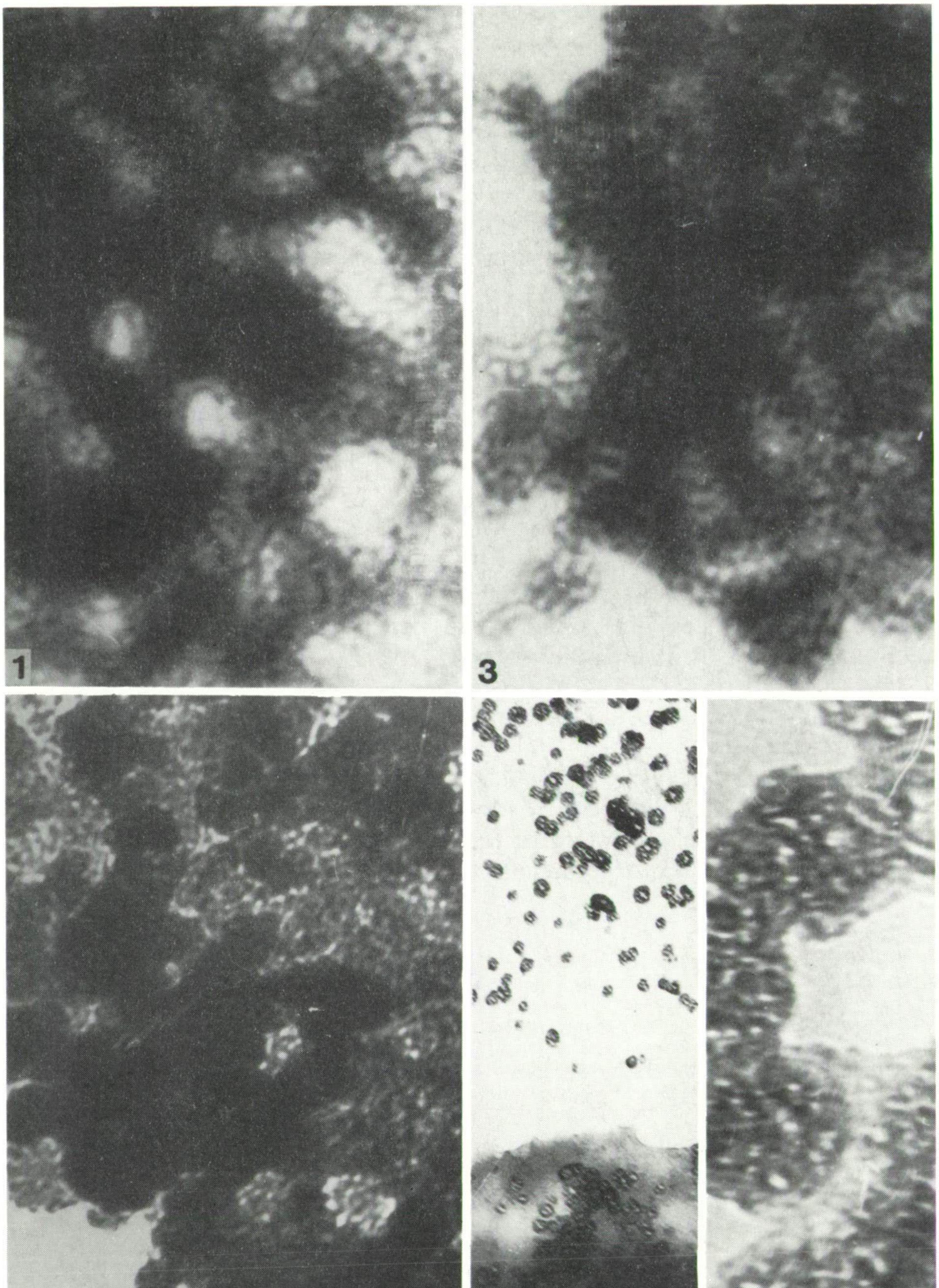

1
2
3
4
5

◀ Plate 5.3.

1—5. *Juniperus virginiana* L.
1,2. Experiment No: 507, biopolymer structure of the exine. The basic pentagonal polygon units are of two different characters. Negative no: 9305, 100.000x.
3,4. Experiment No: 508.
3. Outer surface of the pollen grain with orbiculi. Negative no: 9189, 48.000x.
4. Degraded biopolymer structure of the pollen wall. Negative no: 9191, 100.000x.
5. Experiment No: 509, biopolymer structure of the exine. Negative no: 0028, 250.000x.

Plate 5.4. ▶

1—5. *Juniperus virginiana* L.
1. Experiment No: 510, biopolymer structure of the pollen wall. Negative no: 9224, 250.000x.
2,3. Experiment No: 511, biopolymer organization of the exine.
2. Negative No: 9333, 150.000x.
3. Negative No: 9314, 150.000x.
4,5. Experiment No: 512.
4. The surface of the pollen grain with attached and dispersed orbiculi. Negative no: 9340, 25.000x.
5. Damaged biopolymer structure. Negative no: 9338, 250.000x.


1
3
2
4
5

Experiment No: 509 (Plate 5.3., fig. 5)

A combined globular biopolymer structure was observed. The large units are of 28—56 Å in diameter. This kind of biopolymer organization is extremely similar to those of the globular units of the oil shale organic material (*Botryococcus braunii* KÜTZ., KEDVES et al., 1991, p. 29). This is without doubt highly organized system in this way the PENROSE-I, or II biopolymer unit.

Experiment No: 510 (Plate 5.4., fig. 1)

Not so well defined basic pentagonal polygon units were observed. The highly organized globular structures are also not so characteristic, but the larger polygons are well illustrated in fig. 1, Plate 5.4.

Experiment No: 511 (Plate 5.4., fig. 2,3)

This experiment brought essentially the same result as the previously discussed one.

Experiment No: 512 (Plate 5.4., fig. 4,5)

The low magnified picture (Plate 5.4., fig. 4) well illustrates the orbiculi which are dispersed from the surface. The biopolymer structure of the exine is destroyed. Globular units of 60—100 Å in diameter were observed. These structures are damaged PENROSE-like biopolymer systems. The arrangement of these globular units is filamentous or large polygons.

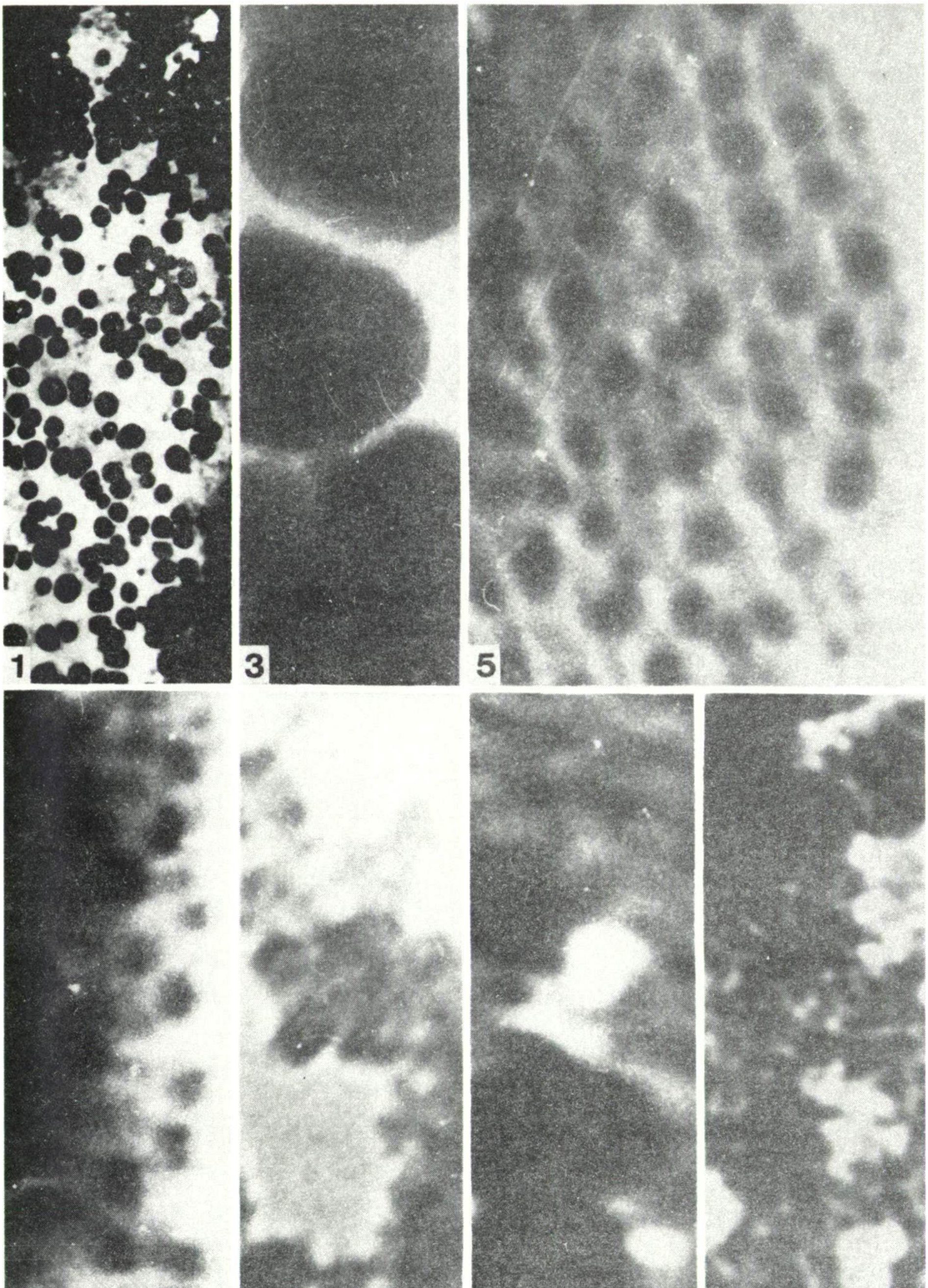
Taxus baccata L.

Experiment No: 513 (Plate 5.5., fig. 1,3)

The low magnified pictures well illustrate the surface of the pollen grain with attached orbiculi which are of extreme electron density. Biopolymer structures were not observed at this experiment.

Plate 5.5 ►

1—7. *Taxus baccata L.*
1,3. Experiment No: 513, the surface of the pollen grain with attached orbiculi.
1. Negative no: 9226, 10.000x.
3. Negative no: 9228, 100.000x.
2,5. Experiment No: 514, the surface of the pollen grain with attached orbiculi.
2. Negative no: 9249, 500.000x.
5. Negative no: 9250, 500.000x.
4. Experiment No: 515, damaged biopolymer structure of the pollen wall. Negative no: 9257, 500.000x.
6. Experiment No: 516, damaged biopolymer structure of the pollen wall. Negative no: 9350, 500.000x.
7. Experiment No: 517, biopolymer structure of the pollen wall. Negative no: 9252, 500.000x.


1
3
5
2
4
6
7

Experiment No: 514 (Plate 5.5., fig. 2,5)

This experiment resulted in different kinds of biopolymer remains. Among these the light-coloured polygon system with globular units in the centre of the "meshed" of each polygon. These "central" globular biopolymer units have strong electron density. The investigation of this "negative" polygon system with the modified MARKHAM rotation method may be the subject of further investigations.

Experiment No: 515 (Plate 5.5., fig. 4)

Not so clearly characteristic biopolymer units were observed. The diameter of these structures are of 24—40 Å approximatively.

Experiment No: 516 (Plate 5.5., fig. 6)

The results of this experiment are similar or nearly identical to the previously mentioned and discussed one.

Experiment No: 517 (Plate 5.5., fig. 7)

Globular units of strong electron affinity were observed. The diameter of these units is 6—8 Å, and forms a quasi-crystalloid lattice. Not so characteristic PENROSE-like globular units were also observed.

Experiment No: 518 (Plate 5.6., fig. 1)

The surface of the pollen grains is seemingly damaged. The orbiculi on the surface are of strong electron density, and its surface coni (spinules) are also degraded.

Experiment No: 519 (Plate 5.6., fig. 3)

Globular units of strong electron density were observed forming more or less pentagonal polygons. Not so characteristic highly organized globular units and their linear and irregular network occurred also during our investigations.

Experiment No: 520 (Plate 5.6., fig. 4)

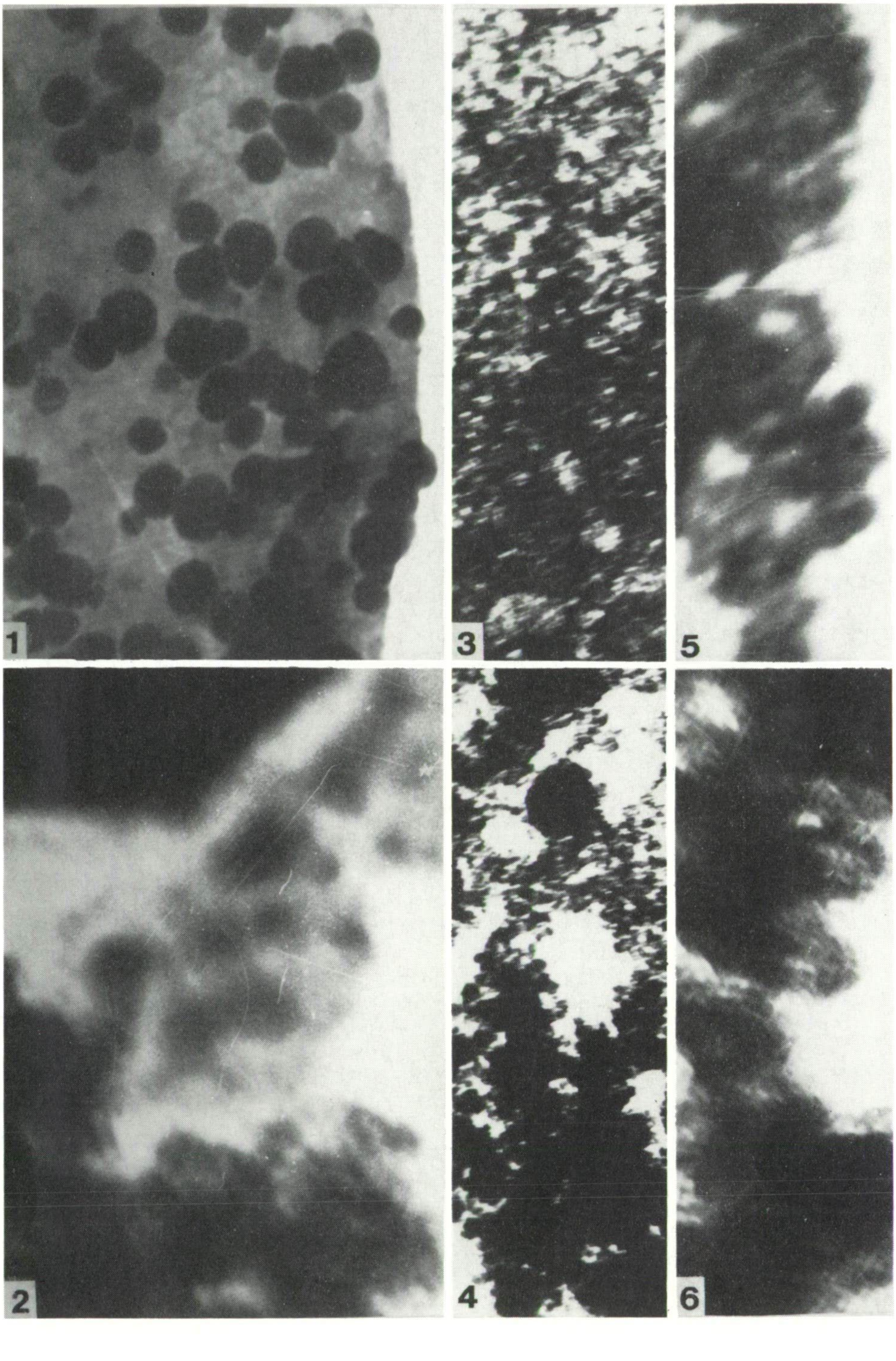
The results of this experiment are similar to the previously discussed one.

Plate 5.6. ▶

1—6. *Taxus baccata* L.

1. Experiment No: 518, surface of the pollen grain with attached orbiculi. Negative no: 9282, 25.000x.

2. Experiment No: 521, biopolymer structure of the pollen wall. Negative no: 9358, 500.000x.
3. Experiment No: 519, biopolymer structure of the pollen wall. Negative no: 9286, 50.000x.
4. Experiment No: 520, biopolymer structure of the pollen exine. Negative no: 9295, 50.000x.
5. Experiment No: 521, biopolymer structure of the pollen wall. Negative no: 9359, 500.000x.
6. Experiment No: 522, biopolymer structure of the pollen wall. Negative no: 9365, 250.000x.



Experiment No: 521 (Plate 5.6., fig. 2,5, plate 5.7.)

The low magnified picture of the exploded pollen grain is illustrated in Plate 5.7. The biopolymer structures of the outer surface and of the orbiculi are well shown. In the highly magnified pictures damaged units of 60—90 Å in diameter were observed. Inside these units there are smaller ones with strong electron density. The diameter is about 8—12 Å. This biopolymer structure is also similar to those observed on the colonies of the *Botryococcus* algue extracted from the oil shale from Pula (Transdanubia, Hungary).

Experiment No: 522 (Plate 5.6., fig. 6)

Relatively well preserved basic biopolymer units and their highly organized structures were observed, including the PENROSE-I like organization.

Discussion and Conclusions

These new data demonstrated the advantages of this method. The TEM study of the fragments brought very useful complementary data to those of the ultrathin sections. The necessity to use combined methods to solve one problem can be emphasized in this place also.

The highly organized biopolymer structures of the exines presented in this paper are similar to or more or less identical with the previously described ones from the wall of *Botryococcus braunii* KÜTZ. (KEDVES et al., 1991) and *Alnus glutinosa* (L.) GAERTN. (KEDVES and ROJIK, 1989).

Acknowledgements

This work was supported by grant OTKA-2, 24/88, and OTKA 1/3, 104.

References

KEDVES, M. and ROJIK, I. (1989): Investigation of the biopolymer organization of partially degraded exines with the fragmentation method. — Acta Biol. Szeged. *35*, 71—80.

KEDVES, M. and ROJIK, I. (1991): Quasi-crystalloid biopolymer organization from the sclereids of *Armeniaca vulgaris* LAM. In: Plant Cell Biology and Development *2*, ed.: M. KEDVES, 59—62, Szeged.

KEDVES, M., ROJIK, I. and VÉR, A. (1991): Biopolymer organization of the partially degraded oil shale with the fragmentation method. In: Plant Cell Biology and Development *1*, ed.: M. KEDVES, 28—31, Szeged.

Plate 5.7. ▶

Taxus baccata L.

Experiment No: 521, pollen grain after explosion. T iopolymer structure is well shown. Negative no: 9360, 60.000x.

6. RECENT MODELLING OF THE MAJOR EVOLUTIONARY DEGREES OF EARLY ANGIOSPERM POLLEN TYPES

M. KEDVES, A. TÓTH, K. MÉSZÁROS, A. BORBOLA, and P. AILER

Cell Biological and Evolutionary Micropaleontological Laboratory of the Department of Botany of the J. A. University, H–6701, P. O. Box 657, Szeged, Hungary

Abstract

Following the most important steps of the DOYLE scheme concerning the angiosperm pollen evolution of each monocolpate, tricolpate and tricolporate pollen types three recent species were investigated. After heating the monosulcate angiosperm pollen grains (*Magnolia, Allium, Chamaedorea*) are similar to the early gymnosperm types. The investigated tricolporate pollen grains are heterogeneous in this point of view. At the heated tricolporate pollen grains the *Longaxones* character and the apertural area transformed in a more characteristic way. The parameters of the axes of the fresh and the heated pollen grains during one hour at 200 °C were compared.

Key words: Palynology, angiosperm *Longaxones,* high temperature effect.

Introduction

The origin of the early angiosperm pollen grains was the subject of several investigations, by several methods. A monograph was published by HUGHES (1976). KREMP (1978) in connection with the regional distribution of the first angiosperm pollen grains gave 8000 references used by the computer method. Among them 800 were useful. DOYLE (1977) published a scheme of the first stage of the evolution of the angiosperm pollen grains. Following this, the monosulcate – tricolpate/tricolporoidate – tricolporate – early *Brevaxones* stages, as the most important in this respect, were pointed out. Later KEDVES (1981) added to this the following: P. 77: "The most important changes in the form and symmetry are as follows:

I. *Longaxones;* monosulcate – tricolpate – tricolporate
II. *Brevaxones;* tricolporate – triporate, triatriate, etc.
1. *Monosulcate* – tricolpate; change in number of the germinal apertures
2. *Tricolpate* – tricolporate; change in the character of the aperture
3. *Tricolporate Longaxones;* shortening of the polar axis."

Our first results on the high temperature effect on recent angiosperm pollen grains (KEDVES and KINCSEK, 1989) are surprising. Further papers on different concepts followed this one, and as it has been emphasized several times, a large research program is under elaboration.

The aim of this paper is to present the first results on the modelling with recent taxa of the high temperature effect of the most important evolutionary steps of the first angiosperm pollen grains.

Materials and Methods

Fresh and heated pollen grains during one hour at 200 °C were the subject of our investigations. The investigated species are the following:
Magnolia soulangeana SOULANGE–BODIN (Plate 6.1., figs. 1–4, text-fig. 6.1. and 6.2.)
Collected: Dr. L. TÉCSI in the Botanical Garden of the J. A. University on 6.4. 1989.
Allium ursinum L. (Plate 6.1., figs. 5–11, text-fig. 6.1. and 6.2.)
Collected: A. CSESZKÓ in the Mecsek Mountains on 3.9. 1989.
Chamaedorea elegans MART. (Plate 6.1., figs. 12–16, text-fig. 6.1. and 6.2.)
Collected: Dr. L. TÉCSI in the Botanical Garden of the J.A. University on 23. 3. 1989.
Helleborus odorus W. et KIT. (Plate 6.1., figs. 17–20, text-fig. 6.1. and 6.2.)
Collected: Dr. I. KINCSEK in the Botanical Garden of the J. A. University on 16. 3. 1989.
Salix caprea L. (Plate 6.1., figs. 21–25, text-fig. 6.1. and 6.2.)
Collected: Dr. I. KINCSEK in the Botanical Garden of the J. A. University on 10. 3. 1989.
Quercus robur L. (Plate 6.1., figs. 26–30, text-fig. 6.1. and 6.2.)
Collected: Dr. M. KEDVES in the Garden of Újszeged (cultivated) on 3. 4. 1989.
Potentilla arenaria BORKH. (Plate 6.1., figs. 31–34, text-fig. 6.1. and 6.2.)
Collected: Dr. I. KINCSEK in Bugac on 31. 3. 1989.
Spiraea media FR. SCHM. (Plate 6.1., figs. 35–39, text-fig. 6.1. and 6.2.)
Collected: Dr. L. TÉCSI in the Botanical Garden of the J. A. University on 6. 4. 1989.
Castanea sativa MILL. (Plate 6.1., figs. 40–47, text-fig. 6.1. and 6.2.)
Collected: Dr. L. TÉCSI in the Botanical Garden of the J. A. University on 21. 6. 1989.

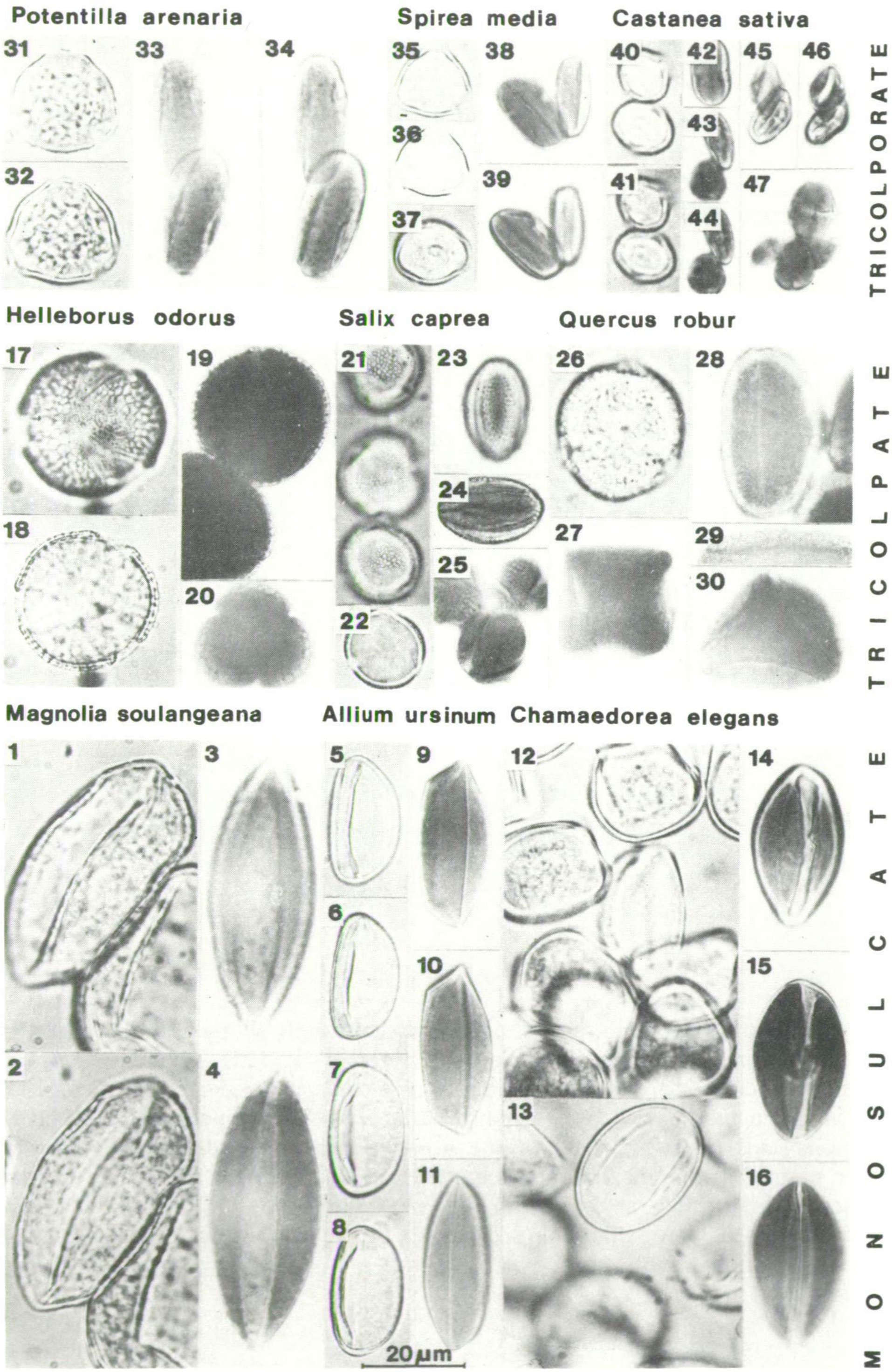
The fresh and the heated pollen grains were mounted in glycerin-jelly, hydrated at 39.6%. 200 specimens of each sample were investigated from the point of view of the qualitative and quantitative alterations. The polar axes in µm (Text-fig. 6.1.) and the values of P/E axis ratio (Text-fig. 6.2.) are illustrated.

Results

MONOSULCATE POLLEN TYPES

Magnolia soulangeana SOULANGE–BODIN (Plate 6.1., figs. 1–4, text-fig. 6.1. and 6.2.)

Outline of the pollen grains after heating is strongly sharpened in contrast to the non-experimental material (Plate 6.1., fig. 3,4). This secondary form is similar to the associated pollen grains of *Wielandiella punctata* NATHORST 1909 following the monograph by POTONIÉ (1962). The variation-statistical graph of the polar axis (Text-fig. 6.1.) of the non-experimental and the experimental pollen grains has one maximum. A characteristic increasing of this character can be established at the heated material. The alteration of the P/E axis ratio is much more expressed, the "sharpening process" of the monosulcate forms is well established (Text-fig. 6.2.).


Potentilla arenaria
Spirea media
Castanea sativa
31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47
TRICOLPORATE
Helleborus odorus
Salix caprea
Quercus robur
17 18 19 20 21 22 23 24 25 26 27 28 29 30
TRICOLPATE
Magnolia soulangeana
Allium ursinum
Chamaedorea elegans
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
20µm
MONOSULCATE

◀ Plate 6.1.

1—4. *Magnolia soulangeana* SOULANGE—BODIN
1,2. Pollen grains without staining or heating.
3,4. Experiment No 587.
5—11. *Allium ursinum* L.
5—8. Pollen grains without staining or heating.
9—11. Experiment No 621.
12—16. *Chamaedorea elegans* MART.
12,13. Pollen grains without staining or heating.
14—16. Experiment No 563.
17—20. *Helleborus odorus* W. et KIT.
17,18. Pollen grains without staining or heating.
19,20. Experiment No 560.
21—25. *Salix caprea* L.
21,22. Pollen grains without staining or heating.
23—25. Experiment No 562.
26—30. *Quercus robur* L.
26. Pollen grains without staining or heating.
27—30. Experiment No 584.
31—34. *Potentilla arenaria* BORKH.
31,32. Pollen grains without staining or heating.
33,34. Experiment No 591.
35—39. *Spiraea media* FR. SCHM.
35—37. Pollen grains without staining or heating.
38,39. Experiment No 593.
40—47. *Castanea sativa* MILL.
40,41. Pollen grains without staining or heating.
42—47. Experiment No 718.

Allium ursinum L.
(Plate 6.1., figs. 5—11, text-fig. 6.1. and 6.2.)

The morphology of the fresh pollen grains is superficially similar to the monolete *Pteropsida* spores without perispore. This peculiar morphology can be observed at one part of the altered forms, in consequence of the high temperature (Plate 6.1., fig. 9,10). Others are similar to recent palm or monosulcate gymnosperm pollen grains. The variation-statistical graph of the polar axis is interesting (Text-fig. 6.1.). The non-experimental and the experimental material has one conspicuous maximum. The minimum value of the experimental material is not so far from the fresh pollen grains. In contrast to this, the character of the variation-statistical graphs of the P/E axis ratio of the fresh and the heated pollen grains (Text-fig. 6.2.) are different. The graph of the fresh pollen grains is similar to those of the polar axis, but the experimental one has several maxima, and the distance between the minimum and maximum values is much more larger than at the non-experimental.

Chamaedorea elegans MART.
(Plate 6.1., figs. 12—16, text-fig. 6.1. and 6.2.)

The sharpening of the pollen grains in consequence of the heating is well shown in Plate 6.1., figs. 14—16. These forms are very similar or identical with the experimental pollen grains of *Encephalartos transvenosus* STAPF et BURTT DAVY (KEDVES and AILER, 1990, p. 105, figs. 10—13). As regards the variation-statistical graphs of the polar axis (Text-fig. 6.1.), essentially a similarity can be established to those of *Allium ursinum*. But the P/E axis ratio is a little different in contrast to the previous.

TRICOLPATE POLLEN GRAINS

Helleborus odorus W. et KIT.
(Plate 6.1., figs. 17—20, text-fig. 6.1. and 6.2.)

No qualitative changes have happened at this species after heating (Plate 6.1., fig. 19,20). The variation-statistical graphs of the polar axis of the non-experimental and experimental pollen grains have their maximum at the same value in μm (Text-fig. 6.1.). However, a diminution of the per cent of the maximum value of the experimental material can be established. This is the trend at the variation-statistical graphs of the P/E axis ratio, too (Text-fig. 6.2.).

Salix caprea L.
(Plate 6.1., figs. 21—25, text-fig. 6.1. and 6.2.)

The most important alteration was the increasing of the polar axis in consequence of the high temperature (Plate 6.1., figs. 23—25). The approximatively globular forms altered into *Longaxones* type. The increasing of the polar axis can be well shown in Text-fig. 6.1. Moreover the graph of the P/E axis ratio of the fresh and the experimental pollen grains well represents this process (Text-fig. 6.2.)

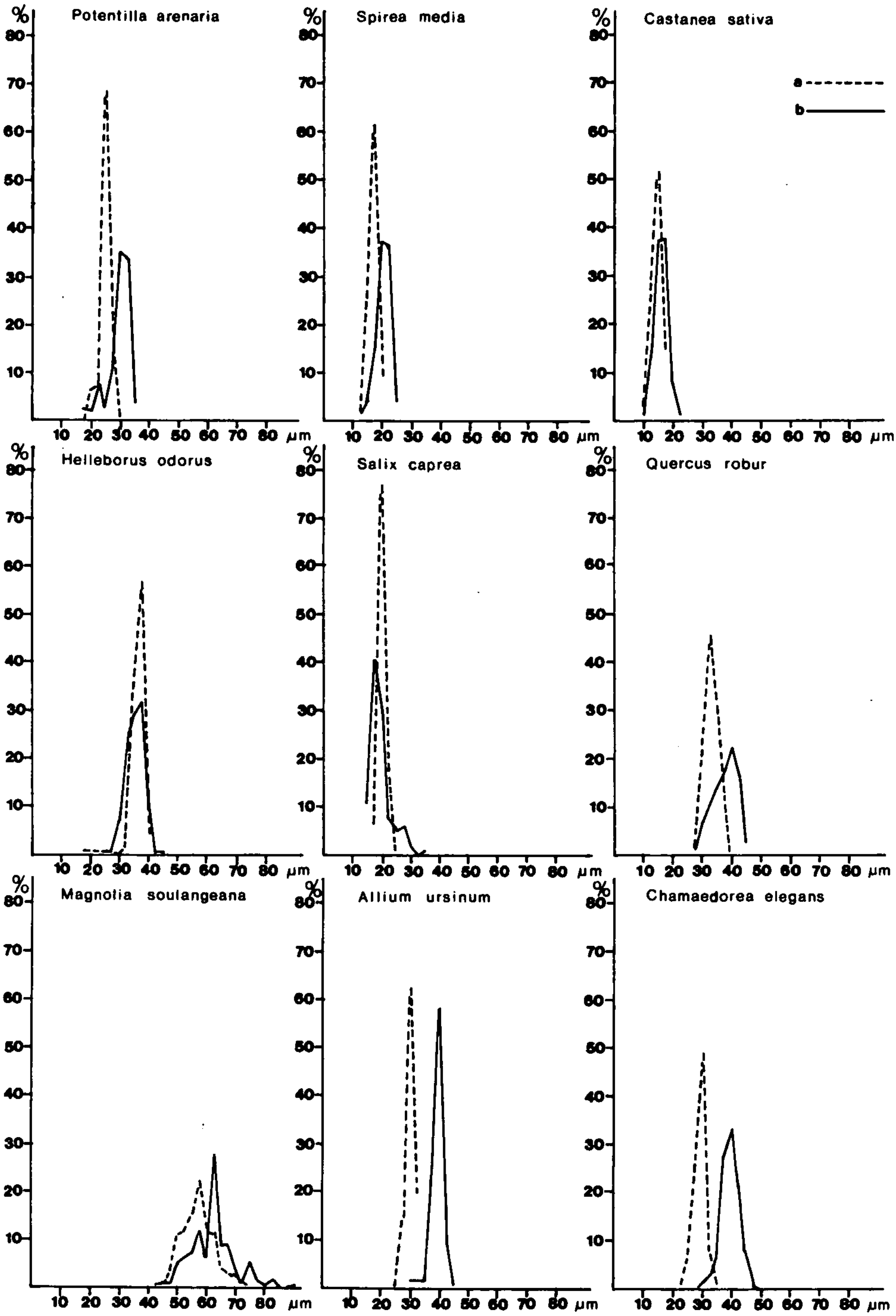
Quercus robur L.
(Plate 6.1., figs. 26—30, text-fig. 6.1. and 6.2.)

At this species heterogeneous and peculiar qualitative alterations have been observed. These are as follows.

i. The elongated *Longaxones* type (Plate 6.1., fig. 28, 29).
ii. *Brevaxones*-like forms (Plate 6.1., fig. 27,30).

Text-fig. 6.1. ▶

Variation-statistical graphs of the polar axis of the investigated pollen grains.
a: Fresh pollen grains.
b: Experimental pollen grains.



%
80
70
60
50
40
30
20
10
10 20 30 40 50 60 70 80 μm
Potentilla arenaria
Spirea media
Castanea sativa
a
b
Helleborus odorus
Salix caprea
Quercus robur
Magnolia soulangeana
Allium ursinum
Chamaedorea elegans

Inside this group plicate triaperturate (Plate 6.1., fig. 30) and tetra-aperturate forms (Plate 6.1., fig. 27) have been observed. These preservation forms are of early *Normapolles*-like types. The increase of the polar axis is well illustrated with the variation-statistical graphs of the non-experimental and the experimental pollen grains (Text-fig. 6.1.). A remarkable difference can be established. This is the same at the P/E axis ratio (Text-fig. 6.2.).

TRICOLPORATE POLLEN GRAINS

Potentilla arenaria BORKH.
(Plate 6.1., figs. 31—34, text-fig. 6.1. and 6.2.)

The alteration of the axis symmetry is extremely characteristic at this species. The contrast of the apertural area in the equatorial region is well shown (Plate 6.1., fig. 33,34). The alteration of the polar axis and the P/E axis ratio are very remarkable. Particularly the variation-statistical graph of the P/E axis ratio of the fresh and experimental pollen grains respectively is quite different.

Spiraea media FR. SCHM.
(Plate 6.1., figs. 35—39, text-fig. 6.1. and 6.2.)

As regards the qualitative and the quantitative alterations, these are essentially the same as the previously discussed species.

Castanea sativa MILL.
(Plate 6.1., figs. 40—47, text-fig. 6.1. and 6.2.)

At this species there are also not so conspicuous differences in the tendencies of the qualitative and quantitative characteristic features, including alterations. As one difference in contrast to the previous two species, the more *Longaxones* character of the fresh material can be pointed out. The experimental material (Plate 6.1., fig. 42—47) is very similar to several fossil tricolporate pollen grains which occur in the Upper Cretaceous and the Tertiary sediments.

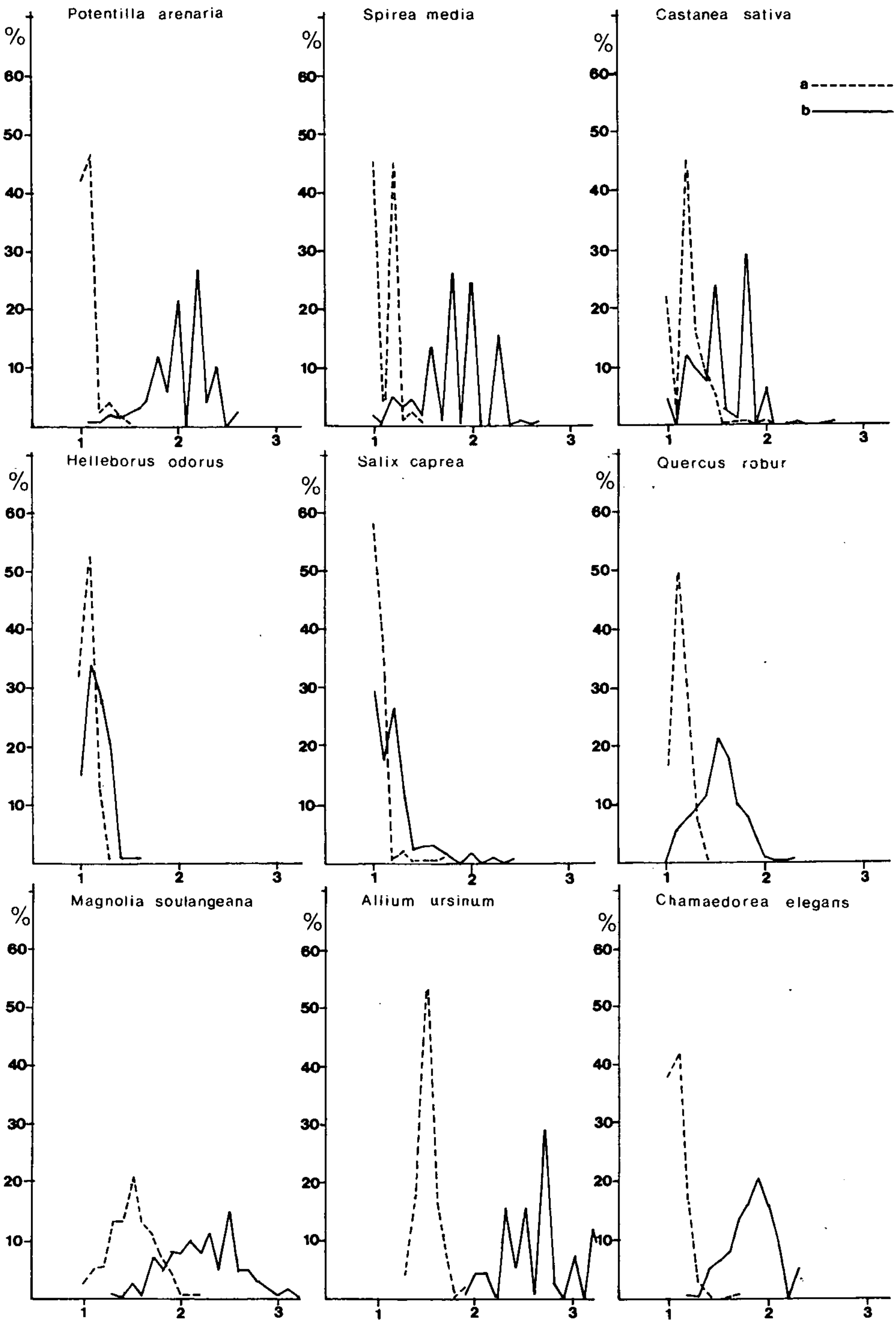
Discussion and Conclusions

The qualitative results of the secondary alterations, as it was emphasized at the first results, too, (KEDVES and KINCSEK, 1989) are heterogeneous in character.

All the investigated monosulcate pollen grains from the *Dicotyledonopsida* and the *Monocotyledonopsida*, after heating are similar to the early monosulcate *Gymnospermatophyta* type. In this respect, the altered forms of *Magnolia*

Text-fig. 6.2. ►

Variation-statistical graphs of the P/E axis ratio of the species investigated.
a: Fresh pollen grains.
b: Experimental pollen grains.


Potentilla arenaria
Spirea media
Castanea sativa
Helleborus odorus
Salix caprea
Quercus robur
Magnolia soulangeana
Allium ursinum
Chamaedorea elegans
%
60
50
40
30
20
10
1
2
3
a
b

soulangeana (dicot.) and *Chamaedorea elegans* (monocot.) can be pointed out. But the altered forms of *Allium ursinum* are similar to *Cycadales* and to some *Palmales*, too.

Important and interesting alterations have been observed at the investigated tricolpate pollen grains. The most common alteration, namely the increasing of the polar axis, was observed at the pollen grains of the genus *Salix*. But the "morphological neutrality" of the pollen grains of *Helleborus odorus* in spite of heating, and the extremely interesting secondary forms at the pollen grains of *Quercus robur* can be pointed out. There are *Longaxones* and *Brevaxones* characters among the secondary altered pollen grains. These latter mentioned genuses (*Helleborus* and *Quercus*) and their taxonomically connected forms may be the subject of further investigations. At other species of the genuses *Helleborus* and *Quercus* it is a question that these have also the same or similar characters in connection with the secondary influences. Is the nearly non-altered polar axis at the pollen grains of *Helleborus odorus* the consequence of the relatively thick pollen wall? Similar secondary phenomenon was observed at the spores of *Equisetum arvense* L. (KEDVES, TÓTH and FARKAS, 1991). The diameter and the wall thickness ratio and the characters of the secondary altered forms may also be a problem to be investigated later.

The investigated tricolporate forms are the most homogeneous in contrast to the previously discussed ones. But it seems that the results of the investigations in the future will bring more interesting complementary data.

Finally, it is necessary to touch the question of the distance between the minimum and maximum values of the variation-statistical graphs. This characteristic feature was previously used in another respect. In connection with this problem the relation of this character to the evolutionary and taxonomically important secondary alterations will also be a problem to be investigated. Our present results in this point of view are as follows.

Polar axis

		minimum	maximum	deviation
Potentilla arenaria	0	17.5 μm	30.0 μm	12.5 μm
	591	17.5 μm	35.0 μm	17.5 μm
Spiraea media	0	12.5 μm	20.0 μm	7.5 μm
	593	12.5 μm	25.0 μm	12.5 μm
Castanea sativa	0	10.0 μm	17.5 μm	7.5 μm
	718	10.0 μm	22.5 μm	12.5 μm
Helleborus odorus	0	17.5 μm	40.0 μm	22.5 μm
	560	27.5 μm	45.0 μm	17.5 μm
Salix caprea	0	17.5 μm	25.0 μm	7.5 μm
	562	15.0 μm	35.0 μm	20.0 μm
Quercus robur	0	27.5 μm	40.0 μm	12.5 μm
	584	27.5 μm	45.0 μm	17.5 μm
Magnolia soulangeana	0	42.5 μm	75.0 μm	32.5 μm
	587	42.5 μm	90.0 μm	47.5 μm
Allium ursinum	0	25.0 μm	32.5 μm	7.5 μm
	621	30.0 μm	45.0 μm	15.0 μm
Chamadorea elegans	0	22.5 μm	35.0 μm	12.5 μm
	563	30.0 μm	47.5 μm	17.5 μm

P/E axis ratio

		minimum	maximum	deviation	increasting
Potentilla arenaria	0	1.0	1.6	0.6	
	591	1.1	2.6	1.5	0.9
Spiraea media	0	1.0	1.5	0.5	
	593	1.0	2.7	1.7	1.1
Castanea sativa	0	1.0	2.0	1.0	
	718	1.0	2.7	1.7	0.7
Helleborus odorus	0	1.0	1.3	0.3	
	560	1.0	1.6	0.6	0.3
Salix caprea	0	1.0	1.7	0.7	
	562	1.0	2.4	1.4	0.7
Quercus robur	0	1.0	1.4	0.4	
	584	1.0	2.3	1.3	0.9
Magnolia soulangeana	0	1.0	2.2	1.2	
	578	1.3	3.4	2.1	0.9
Allium ursinum	0	1.3	1.9	0.6	
	621	1.9	3.4	1.5	0.8
Chamaedorea elegans	0	1.0	1.7	0.7	
	562	1.2	2.3	1.1	0.4

At this moment it is not so easy to interpret these data but probably these will be useful after the complementary investigations.

Acknowledgements

This work was supported by the grant OTKA 1/3, 104.

References

Doyle, J. A. (1977): Patterns of evolution in early *Angiosperms*. — Patterns of Evolution, 501—546.

Hughes, N. F. (1976): Palaeobiology angiosperm origin. — Cambridge Univ. Press.

Kedves, M. (1981): The evolutionary significance of the angiospermous exine ultrastructure and sculpture. — Inter. Symp. Concpt. Meth. Paleo. Barcelona, 1981, 75—83.

Kedves, M. and Ailer, P. (1990): Investigations on recent monosulcate *Gymnospermatophyta* pollen grains. — Acta Biol. Szeged. *36*, 103—105.

Kedves, M. and Kincsek, I. (1989): Effect of the high temperature on the morphological characteristic features of the sporomorphs I. — Acta Biol. Szeged. *35*, 233—235.

Kedves, M., Tóth, A. and Farkas, E. (1991): High temperature effects on the spores of *Equisetum arvense* L. In: Plant Cell Biology and Development 1, ed.: M. Kedves, 8—14, Szeged.

Kremp, G. O. W. (1978): The earliest appearance worldwide of tricolpate pollen and the origin of *Angiosperms*. — Abstr. Amer. Assoc. Stratigraphic Palynologists Eleventh Ann. Mtg. 23.

Potonié, R. (1962): Synopsis der Sporae in situ Die Sporen der fossilen Fruktifikationen (*Thallophyta* bis *Gymnospermatophyta*) im natürlichen System und im Vergleich mit den Sporae dispersae. — Beih. Geol. Jb. *52*, 1—204.

7. THE THERMAL ALTERATIONS OF THE POLLEN GRAINS OF VISCUM ALBUM L. (LORANTHACEAE, S. STR. VISCACEAE)

Short communication

E. GOTTL

Cell Biological and Evolutionary Micropaleontological Laboratory of he Department of Botany of the J. A. University, H—6701, P. O. Box 657, Szeged, Hungary

The taxonomical and phylogenetical importance of the high temperature effect on the basic morphology of the sporomorphs was reported first by KEDVES and KINCSEK (1989). Modelling of the most important evolutionary steps of the angiosperm pollen grains is one of the most significant research programmes of the laboratory. The subject of this short communication is in close connection with the upper mentioned paper (KEDVES et al., 1993). The hemiparasitic character and the palynological pecularities of the *Loranthaceae* attracted our attention to this species.

The occurrences of *Viscum album* L. in Hungary were investigated by ROTH (1926) with complementary data by BOROS (1926). According to ROTH (1926) the occurrence of *Viscum album* L. on *Pirus malus* L. is very common including further woody species of the *Rosaceae.* But there are several observations about the occurrence on *Robinia pseudoacacia* L., *Salix* spp., *Tilia* spp., and *Abies alba* MILL. The investigation material was collected by Dr. S. GULYÁS and Dr. I. SZŐLLŐSI on 28. 3. 1991 from *Pyrus communis* L. in the woods of Zalaegerszeg. Fresh and pollen grains heated on 200 °C during one hour were the subject of the investigations. The pollen grains were mounted in glycerin-jelly hydrated of 39.6 per cent.

Regarding the LM morphology of the pollen grains of the *Loranthaceae* there are a number of publications. On the basis of the book of ERDTMAN (1952) the earliest data were published by KOELREUTER in 1763 in this subject. It is necessary to emphasize the important contribution to the angiosperm bibliography by THANIKAIMONI (e. g.: 1972, 1980, 1986). FEUER and KUIJT (1982) published important TEM results. The investigated material was classified into two groups on the basis of the pollen and flower morphological characteristic features with *Viscum album* in the second one, the pollen grains of which are characterized by rodlets and echinate sculptural elements.

The basic LM morphological characteristic features of the fresh pollen grains are as follows.

The pollen grains are tricolpate (tricolporoidate) (Plate 7.1., fig. 1—4, 17—20). Amb circular. Exine tectate, perforate with supratectate ornamentation. The sculpture is heterogeneous. In the inter-apertural area there are roods (baculi) ranging from 2.5 to 3.5 μm (Plate 7.1., fig. 3, 17). Particularly in the colpus margin (area) there are tiny ornamental elements, rodlets or spinae. Endexine and intine are relatively thick.

The alterations of the pollen grains after heating are peculiar (Plate 7.1., figs. 5—16, fig. 21). These are a little similar to those observed at the pollen grains of *Quercus robur,* see in the previous contribution (KEDVES et al., 1993).

1. There are characteristic *Longaxones* forms (Plate 7.1., figs. 11—16). At these pollen grains the colpal area is typical with colpus margin or costae.

2. Some forms are similar to *Brevaxonate* types (Plate 7.1., fig. 7—10).

3. Finally there are forms without remarkable alteration (Plate 7.1., fig. 5, 6).

The quantity of the pollen material was not sufficient for establishing the variation-statistical graphs of the alterations in the size and the P/E axis ratio. But the diameter of the fresh pollen grains is 33.0.—40.0—45.0 μm. The more or less isodiametric pollen grains after heating are about of 35.0—42.5 μm in diameter. The difference between the fresh and the experimental material is not important. The P/E axis ratio of the "elongated" pollen grains is for example the following: 50.0/35.0 μm. 47.5/32.5 μm, 45.0/37.5 μm, etc.

Summary: the alterations in consequence of high temperature have an intermediate character, which is similar to the hemiparasitic physiology.

Acknowledgements

This work was supported by the grant OTKA 1/3, 104. The author is deeply indebted to Prof. Dr. M. KEDVES for his advice.

References

BOROS, Á. (1926): Kiegészítő adatok a fehér fagyöngy hazai elterjedéséhez. — Erdészeti Kísérletek *28,* 64—67.

ERDTMAN, G. (1952): Pollen morphology and plant taxonomy Angiosperms (An Introduction to Palynology. I). — Almqvist and Wiksell, Stockholm.

FEUER, S. M. and KUIJT, J. (1985): Fine structure of misletloe pollen VI. Small-flowered Neotropical *Loranthaceae.* — Ann. Missouri Bot. Gard. *72,* 187—212.

KEDVES, M. and KINCSEK, I. (1989): Effect of the high temperature on the morphological characteristic features of the sporomorphs I. — Acta Biol. Szeged. *35,* 233—235.

KEDVES, M., TÓTH, A., MÉSZÁROS, K., BORBOLA, A. and AILER, P. (1993): Recent modelling of the major evolutionary degrees of early angiosperm pollen types. In: Plant Cell Biology and Development *4,* ed.: M. KEDVES, Szeged.

ROTH, GY. (1926): A fehér fagyöngy (*Viscum album* L.) elterjedése hazánkban. — Erdészeti Kísérletek 28, 44—63.

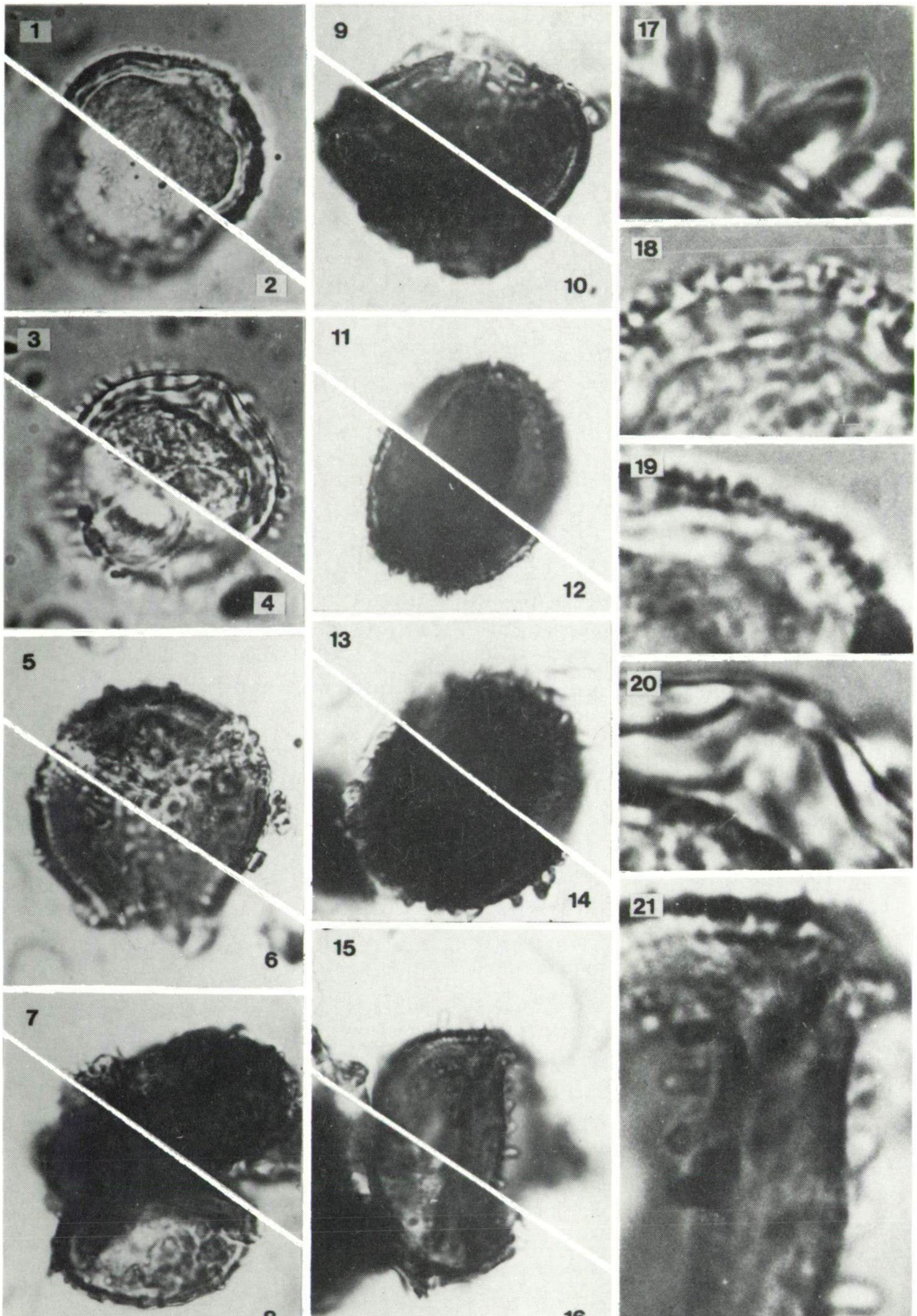
THANIKAIMONI, G. (1972): Index bibliographique sur la morphologie des pollens d'Angiospermes. — Inst. Français de Pondichéry. Trav. de la Sect. Sci. et Techn. *12,* 1—337.

THANIKAIMONI, G. (1980): Quatrième index bibliographique sur la morphologie des pollens d'Angiospermes. — Inst. Français de Pondichéry. Trav. de la Sect. Sci. et Techn. 17, 1—336.

THANIKAIMONI, G. (1986): Cinquième index bibliographie sur la morphologie des pollens d'Angiospermes. — Inst. Français de Pondichéry. Trav. de la Sect. Sci. et Techn. *22,* 1—293.

Plate 7. 1. ▶

1.—21.	*Viscum album* L., recent.
1.—4.	Fresh pollen grains. 1000x.
5.—16.	Experiment No 1055. 1000x.
17.—21.	Experiment No 1055. 3000x.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21

8. NEGATIVE QUASI-CRYSTALLOID BIOPOLYMER NETWORK FROM THE EXOSPORE OF EQUISETUM ARVENSE L.

Short communication

M. KEDVES[1] and Á. PÁRDUTZ[2]

1. Cell Biological and Evolutionary Micropaleontological Laboratory of the Department of Botany of the J. A. University, H–6701, P. O. Box 657, Szeged, Hungary, 2. Institute of Biophysics, Biological Research Center of the Hungarian Academy of Sciences, H–6701, P. O. Box 521, Szeged, Hungary

The presence of the quasi-crystalloid biopolymer structure in living organism was discovered in 1988 (KEDVES) on partially degraded ectexine of *Pinus griffithii* MCCLELL. The method of investigation of this PENROSE-like biopolymer system was elaborated in further papers (e. g.: KEDVES 1989, 1990, KEDVES and FARKAS, 1991, etc.) and several problems are now being investigated. During this kind of research as the first, and fundamental process, the stabilizing biopolymer system of the metastable quasi-crystalloid skeleton was dissolved and/or oxidized. After this step of experiment, different kinds of methods were used.

Among the study of the quasi-crystalloid skeleton as an important necessary part of this program the investigation of the stabilizing biopolymer system of the quasi-crystalloid skeleton was projected. To dissolve the quasi-crystalloid biopolymer system organic solvents of pentagonal molecular symmetry were believed to be the best (GÉVAY and KEDVES, 1989). Using different kinds of solvents, for the first attempt this basic research concept was not justified in

Plate 8.1. ▶

1–4. *Equisetum arvense* L.
TEM pictures of the exospore after partial degradation with diethyl-ether. Experiment No: 678. TEM pictures were taken by Dr. Á. PÁRDUTZ on a Zeiss EM 10 C instrument in the Max-Planck-Institut für biophysikalische Chemie, Karl-Friedrich-Bonhoeffer-Institut, D–3400 Göttingen-Nikolausberg, German Federal Republic.

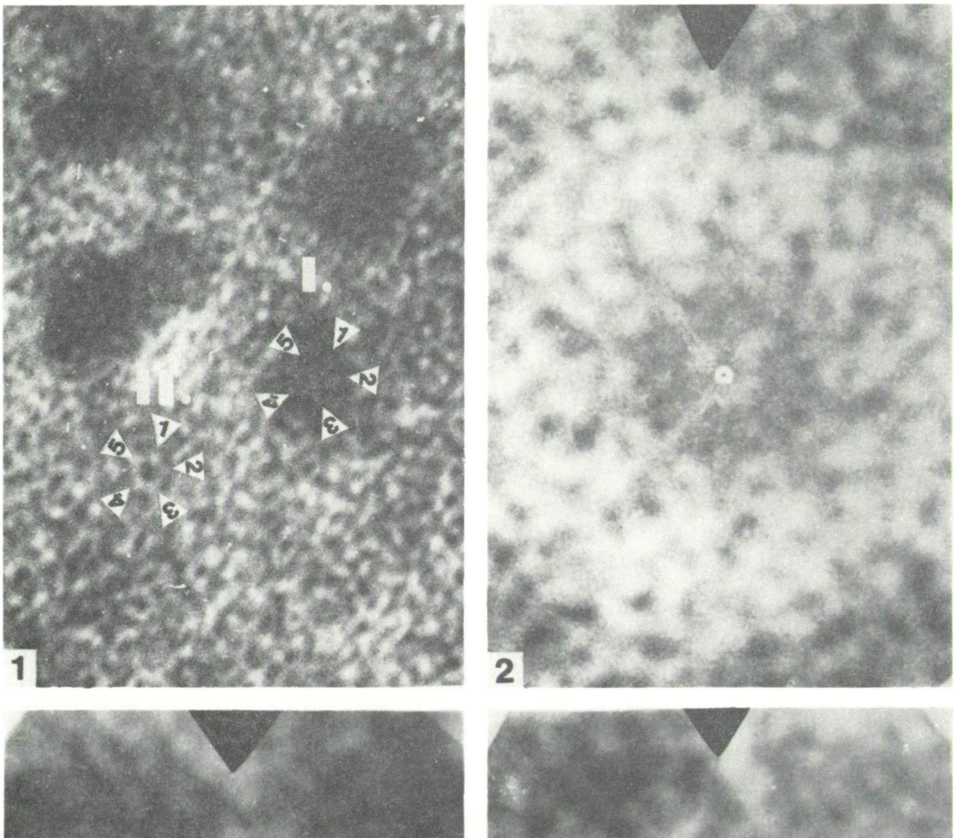
1. TEM picture of the partially degraded exospore. The negative quasi-crystalloid network system, and the different kinds of stabilizing biopolymer units are illustrated. Two "negative regular pentagonal polygons" were chosen for symmetry operations. Negative no: 431, 500 000x.

2–4. Rotation pictures of the biopolymer hole No II. The magnification of all pictures is 1 Million.

2. C.P.5.A.5.10.

3. C.S.$Y_{-1/1}$.5.5.

4. C.S.$Y_{+2/3}$.5.5.


1
I.
II.
2
3
4

every respect. But using the solvent of diethyl-ether to the spores of *Equisetum arvense* L., the dissolution of the quasi-crystalloid skeleton was successful. In Plate 8.1. a part of the results of this program is presented, with the remark, that the detailed results will be the subject of further papers. Fig. 1 (Plate 8.1.) represents the "negative quasi-crystalloid network biopolymer system" with dark stabilizing molecular structures. Two regular pentagonal polygons were chosen for investigation with the modified MARKHAM rotation method (Plate 8.1., figs. 2—4). The first methodological concepts will also be published later. But in this preliminary report it is also necessary to emphasize that during the different kinds of rotations we are "working" at the same time with the "negative" and "positive" points of symmetries. These points are the holes of the dissolved quasi-crystalloid skeleton ("negative units"), or the biopolymer units of the stabilizing system. As most important first result the negative PENROSE-like structure can be emphasized (Plate 8.1., fig. 4).

This work was supported by the grant OTKA 1/3, 104.

References

GÉVAY, G. and KEDVES, M. (1989): A structural model of the sporopollenin based on dodecahedrane units.) Acta Biol. Szeged. *35*, 53—57.

KEDVES, M. (1988): Quasi-crystalloid basic molecular structure of the sporoderm. — 7 Internat. Palynol. Congr. Brisbane, Abstracts, 82.

KEDVES, M. (1989): Méthode d'étude des biopolymères de la paroi pollinique à structure quasi-cristalloïde. — Rev. de Micropaléontologie *32*, 226—234.

KEDVES, M. (1990): Quasi-crystalloid basic molecular structure of the sporoderm. — Rev. Palaeobot. Palynol. *64*, 181—186.

KEDVES, M. and FARKAS, E. (1991): Basis of the tertiary rotation and TICOS modelling of the quasi-crystalloid biopolymer skeleton of the plant cell. In: Plant Cell Biology and Development *2*, ed.: M. KEDVES, 36—42, Szeged.

9. LIST OF PUBLICATION OF M. KEDVES I.

compiled by

E. GOTTL

Cell Biological and Evolutionary Micropaleontological Laboratory of the Department of Botany of the J. A. University, H—6701, P. O. Box 657, Szeged, Hungary

1955

— — : Egy kovásodott fatörzsmaradvány xylotomiai vizsgálata. — Tud. diákköri dolgozatok, *II/b*, 3—7.
Key words: Xylotomy, fossil, *Gymnospermatophyta*, n. sp., Mesozoic, Hungary.

1957

SIMONCSICS, P. — KEDVES, M.: Eine neue *Sequoia*-Reste aus dem Pannon der Balaton-See-Gegend. — Acta Biol. Szeged. *3*, 19—23.
Key words: Xylotomy, fossil, *Gymnospermatophyta*, n. sp., Tertiary, Hungary.

1958

— — a: Az *Equisetum* fajok epidermiszének vizsgálata. — Egyetemi doktori értekezés, Szeged.
Key words: Histology, epidermis, recent, *Equisetum*.
— — b: Untersuchung der Spaltöffnungsapparaten von *Equisetum*. — Acta Biol. Szeged. *4*, 149—155.
Key words: Histology, epidermis, recent, *Equisetum*.

1959

— — a: Xylitbestimmungen aus den Bohrungen bei Ganna und Herend. — Acta Biol. Szeged. *5*, 17—23.
Key words: Xylotomy, fossil, *Gymnospermatophyta*, Tertiary, Hungary.
— — b: Morphologische Variationen der waagrechten Wand des Längsparenchyms im Holz von *Taxodium ascendens* BRONGN. — Acta Biol. Szeged. *5*, 161—165.
Key words: Xylotomy, recent, *Gymnospermatophyta*.
— — c: Palynologische Untersuchungen der miozänen Braunkohlen der Herend 13 Bohrung. — Acta Biol. Szeged. *5*, 167—179.
Key words: Palynology, fossil, Miocene, Hungary.

1960

— — a: Études palynologiques dans le Bassin de Dorog, —I—. — Pollen et Spores *2*, 89—118.
Key words: Palynology, fossil, n. fspp., Eocene, Hungary.
— — b: Palynologische Untersuchungen an Braunkohlen von Várpalota. — Acta Biol. Szeged. *6*, 43—56.
Key words: Palynology, fossil, Miocene, Hungary.

1961

— — a: Études palynologiques dans le Bassin de Dorog —II—. — Pollen et Spores *3*, 101—153.
Key words: Palynology, fossil, n. fgen., n. fspp., Eocene, Hungary.

— — b: Beobachtungen an den Pollen des rezenten *Ginkgo biloba* L. mit besonderer Hinsicht auf die Fragen der Determination der fossilen Pollen der *Ginkgoinae.* — Acta Biol. Szeged. *7*, 31—37.
Key words: Palynology, recent, *Ginkgo*, form-variation.

— — c: Zur palynologischen Kenntnis des unteren Eozäns von Halimba. — Acta Biol. Szeged. *7*, 25—41.
Key words: Palynology, fossil, n. fsp., Eocene, Hungary.

GREGUSS, P. — KEDVES, M.: Contributions à la connaissance des troncs d'arbre mésozoïques de la Hongrie (en Hongrois résumé en Français et en Russe). — MÁFI évi jel. az 1957—58. évről, 435—444.
Key words: Xylotomy, fossil, Mesozoic, Hungary.

SIMONCSICS, P. — KEDVES, M.: Palaeobotanical examinations on manganese series in Úrkút (Hungary, Transdanubia). — Acta Miner. - Petr. *14*, 27—57.
Key words: Palynology, fossil, Jurassic, n. fgen., n. fspp., Hungary.

1962

— — a: Études palynologiques de quelques échantillons du Bassin de Tatabánya. — Pollen et Spores *4*, 155—168.
Key words: Palynology, fossil, Palaeoecology, Eocene, Hungary.

— — b: *Noremia*, a new microfossil genus from the Hungarian Eocene, and systematical and stratigraphical problems about the *Crassosphaeridae.* — Acta Miner. - Petr. *15*, 19—27.
Key words: Palynology, organic plankton, fossil, n. gen., n. sp., Eocene, Hungary.

— — c: Palynologic investigations on the freshwater limestone layer of Lábatlan, and an attempt to divide the Hungarian Lower Eocene floras on palynologic basis. — Acta Biol. Szeged. *8*, 63—69.
Key words: Palynology, fossil, Palaeoecology, Eocene, Hungary.

— — d: Palynologic investigations on the Lower Eocene layers in the surrounding country of Iszkaszentgyörgy I. — Acta Biol. Szeged. *8*, 71—75.
Key words: Palynology, fossil, Eocene, Hungary.

— — e: Palynologic investigation on coals of the Upper Pannonian I. — Acta Biol. Szeged. *8*, 77—81.
Key words: Palynology, fossil Palaeoecology, Pliocene, Hungary.

— — f: *Nagyipollis*, a new pollen fgen. from the Hungarian Lower Eocene. — Acta Biol. Szeged. *8*, 83—84.
Key words: Palynology, fossil, n. fgen., n. fsp., Eocene, Hungary.

SIPOS, É. — KEDVES, M.: Einige Fragen betreffs des Bitumen- und Huminsäuregehaltes von ungarländischen tertiären Braunkohlen. (Ungarisch mit russische und deutsche Zusammenfassung). — Szegedi Tanárképző Főisk. Tud. Közl., 229—238.
Key words: Palynology, brown coal chemistry, Eocene, Hungary.

1963

— — a: Complexes sporo-polliniques des couches tertiaires inférieures du sondage V. No. 133 de Várpalota (Rapport préalable). — Acta Bot. Acad. Sci. Hung. *9*, 25—30.
Key words: Palynology, fossil, Palaeoecology, Eocene, Hungary.

— — b: Contribution à la flore éocène inférieure de la Hongrie sur la base des examens palynologiques des couches houillères du puits III d'Oroszlány et du puits XV/b de Tatabánya. — Acta Bot. Acad. Sci. Hung. *9*, 31—66.
Key words: Palynology, fossil, n. fsp., Eocene, Hungary.

— — c: Stratigraphie palynologique des couches éocènes de Hongrie. — Pollen et Spores *5*, 149—159.
Key words: Palynology, fossil, stratigraphy, Eocene, Hungary.

Kedves, M. — Sole de Porta, N.: Comparación de las esporas del género *Cicatricosisporites* R. Pot. y Gell. 1933 de Hungría y Colombia. Algunos Problemas referente a su significado estratigráfico. — Bol. de Geol. Univ. Ind. de Santander *12*, 51—76.
Key words: Palynology, fossil, n. fspp., stratigraphy, Eocene, Oligocene, Miocene, Colombia, Hungary.
Sipos, É., Kedves, M. — Endrédi, L.: Untersuchungen über den Bitumen- und Huminsäuregehalt der die aus dem unteren Eozän stammenden Kohlenhaltigen Deckschichten der Bauxitfelder bei Iszkaszentgyörgy bildenden Vegetationstypen. (Ungarisch mit russische und deutsche Zusammenfassung). — Szegedi Tanárképző Főisk. Tud. Közl., 229—234.
Key words: Palynology, brown coal chemistry, Eocene, Hungary.
Sipos, É., Kedves, M. — Sipos, S.: Komplexuntersuchungen an den Kohlenschichten aus dem unteren Eozän im III. Schacht des Bergwerkes Oroszlány. (Ungarisch mit russische und deutsche Zusammenfassung). — Szegedi Tanárképző Főisk. Tud. Közl., 235—239.
Key words: Palynology, brown coal chemistry, Eocene, Hungary.

1964

— — a: Pollenstratigraphie der eozänen Schichten der Bohrung Nr. L.—4. von Lábatlan. (Ungarisch mit deutsche und russische Zusammenfassung). — MÁFI évi jel. az 1962 évről, 251—255.
Key words: Palynology, fossil, stratigraphy, Eocene, Hungary.
— — b: Présence de couches paléocènes en Hongrie d'après les résultats des études palynologiques. — Pollen et Spores *6*, 203—207.
Key words: Palynology, fossil, (Paleocene) Eocene, Hungary.
— — c: Sporomorphes nouveaux des couches Eocènes de Hongrie. — Pollen et Spores *6*, 195—201.
Key words: Palynology, fossil, n. fsp., Eocene, Hungary.
— — d: Palynológiai vizsgálatok dunántúli paleogén rétegeken. — Kandidátusi Értekezés Tézisei, 3—5.
Key words: Palynology, fossil, Eocene, Oligocene, Hungary.
Kedves, M. — Rákosy, J.: *Intrabaculisporis* n. fgen. du Pannonien supérieur de Hongrie. — Pollen et Spores *6*, 593—596.
Key words: Palynology, fossil, n. fgen., n. fsp., Pliocene, Hungary.
Kedves, M. — Simoncsics, P. a: Microstratigraphy of the carbonate manganese ore layers of the Shaft III. of Úrkút on the basis of palynological investigations. - Acta Miner.-Petr. *16*, 3—48.
Key words: Palynology, fossil, n. fgen., n. fspp., Jurassic, Hungary.
Kedves, M. — Simoncsics, P. b: Spores nouvelles extraites de minerai de manganèse jurassique de la Région d'Úrkút (Hongrie). — Pollen et Spores *6*, 605—610.
Key words: Palynology, fossil, microstratigraphy, n. fgen. et fsp., Jurassic, Hungary.

1965

— — a: Palynological investigations on the Lower Eocene layers in the surrounding country of Iszkaszentgyörgy III. — Acta Biol. Szeged. *11*, 33—50.
Key words: Palynology, fossil, n. fsp., Eocene, Hungary.
— — b: Beiträge zur Kenntnis der oberpaläozoischen und untermesozoischen Sporen-Pollengesellschaften in Ungarn. — Acta Miner.-Petr. *17*, 19—27.
Key words: Palynology, fossil, stratigraphy, Paleozoic — Mesozoic, Hungary.
— — c: Contributions à la connaissance palynologique de l'Eocène hongrois. — Acta Bot. Hung. *11*, 325—360.
Key words: Palynology, fossil, stratigraphy, n. fgen., n. fspp., Eocene, Hungary.
— — d: Ein neuer reticulater Sporen-Typ aus dem Eozän des Braunkohlenbeckens von Dorog (Ungarn). — Paläont. Z. *39*, 188—192.
Key words: Palynology, fossil, n. fsp., Eocene, Hungary.
— — e: A new *Restionaceae* pollen type from the Hungarian Lower Tertiary layers. — Advancing Frontiers of Plant Sciences *13*, 49—54.
Key words: Palynology, fossil, n. fsp., Eocene, Hungary.
Kedves, M. — Endrédi, L.: Palynologic investigations on the Lower Eocene layers in the surrounding country of Iszkaszentgyörgy IV. — Acta Biol. Szeged. *11*, 229—231.

Key words: Palynology, fossil, stratigraphy, Eocene, Hungary.
KEDVES, M. — RÁKOSY, J. a: Palynological investigations on the Eocene layers of Boring 39. in Eplény. — Acta Biol. Szeged. *11*, 51—53.
Key words: Palynology, fossil, stratigraphy, Eocene, Hungary.
KEDVES, M. — RÁKOSY, J. b: Zonotrilete microspores from the Eocene bauxite layers of Gánt in Hungary. — Acta Biol. Szeged. *11*, 233—244.
Key words: Palynology, fossil, n. fgen., n. fspp., Eocene, Hungary.

1966

— — a: Palynological data concerning the Eocene brown coal complex of Solymár (Buda—Pilis Mountain). (Hungarian, summary in English and in Russian). — MÁFI évi jel. az 1964 évről, 339—347.
Key words: Palynology, fossil, n. fsp., Eocene, Hungary.
— — b: Contributions sporo-polliniques à la connaissance paléobotanique des couches fossilifères de la marnière de Tatabánya. — Acta Bot. Acad. Sci. Hung. *12*, 55—88.
Key words: Palynology, fossil, n. fgen., n. fspp., Eocene, Hungary.
— — c: Palynologische Untersuchungen der Eozän-Braunkohlenschichten des doroger Beckens im Gebiet von Csolnok. — Grana Palynologica *6*, 290—296.
Key words: Palynology, fossil, stratigraphy, Eocene, Hungary.
KEDVES, M. — ADORJÁN, A. M.: Pollens fossiles de la famille des *Onagraceae* des couches paléogènes de la Hongrie. — Acta Biol. Szeged. *12*, 37—48.
Key words: Palynology, fossil, stratigraphy, n. fgen., n. fsp., Tertiary, Hungary.
KEDVES, M. — BOHONY, E. a: Observations sur quelques pollens de palmiers provenant des couches tertiaires de Hongrie. — Pollen et Spores *8*, 141—147.
Key words: Palynology, fossil, n. fsp., Pliocene, Hungary.
KEDVES, M. — BOHONY, E. b: Kurzer Überblick über die palynologischen Ergebnisse aus dem Praequartär Ungarns mit besonderer Berücksichtigung der stratigraphischen Stellung des urkuter Manganerzes. — Acta Miner.-Petr. *17*, 115—122.
Key words: Palynology, fossil, stratigraphy, Permian — Pliocene, Hungary.
KEDVES, M., ENDRÉDI, L. — SZELEY, Zs.: Problèmes palynologiques concernant le remaniement des sédiments paléo- et mésozoiques dans des Bassins du Pannonien supérieur de Hongrie. — Pollen et Spores *8*, 315—336.
Key words: Palynology, fossil, recycling, Hungary.
KEDVES, M. — JUHÁSZ, M.: Spore-pollen data of the Eocene brown coal layers from the Bükk Mountain (Hungary). — Advancing Frontiers of Plant Sciences *17*, 103—107.
Key words: Palynology, fossil, Eocene, Hungary.
KEDVES, M. — KEREPECZKY, J.: Variation-statistical examinations on Eocene trilete spores. — Advancing Frontiers of Plant Sciences *17*, 108—114.
Key words: Palynology, fossil, variation-statistic, Eocene, Hungary.
KEDVES, M. — KOLOSVÁRY, G.: Eozän-Korallen und faziesökologisch-biostratigraphisch bemerkenswerte Sporomorphen aus dem Bakony-Gebirge betrachtet. — Acta Biol. Szeged. *12*, 49—53.
Key words: Palynology, coral research, fossil, Eocene, Hungary.

1967

— — a: Études palynologiques des couches du Tertiaire inférieur de la Région Parisienne. I. Spores. — Pollen et Spores *9*, 521—552.
Key words: Palynology, fossil, Paleocene, Eocene, France.
— — b: Spore pollen data from the London Clay. — Acta Biol. Szeged. *13*, 25—30.
Key words: Palynology, fossil, Eocene, London Clay, UK.
— — c: Quelques types de sporomorphes du Bassin lignitifère de Menat. — Acta Biol. Szeged. *13*, 11—23.
Key words: Palynology, fossil, n. fsp., Paleocene, France.
— — d: Sur quelques problèmes de stratigraphie palynologique appliquée au Tertiaire inférieur en Europe. — Pollen et Spores *9*, 321—334.

Key words: Palynology, fossil, stratigraphy, Paleocene — Eocene, Europe.
KEDVES, M. — DINIZ, F.: Quelques types de sporomorphes de sediments crétacés d'Aveiro, Portugal. — Com. Serv. Geol. Portugal *52*, 17—27.
Key words: Palynology, fossil, Cretaceous, Portugal.
KEDVES, M. — KARÁCSONYI, M.: The recycled sporomorphs of the boring No. NY—1 in Kecskemét. — Acta Biol. Szeged. *13*, 11—13.
Key words: Palynology, fossil, recycling, Hungary.
KEDVES, M. — RÁKOSY, J.: Evaluation of the spore-pollen assemblage of the bauxite in Gánt. — Acta Biol. Szeged. *13*, 15—18.
Key words: Palynology, fossil, stratigraphy, Eocene, Hungary.

Book reviews

— — a: GÓCZÁN, F., GROOT, J. J., KRUTZSCH, W. — PACLTOVÁ, B.: Die Gattungen des "Stemma *Normapolles* PFLUG 1953 b" (*Angiospermae*). — Paläont. Abh. Abt. B. Berlin, 1967, 427—633. — Bot. Közlem. *54*, 230.
— — b: GREGUSS, P.: Fossil gymnosperm woods in Hungary from the Permian to the Pliocene. — Akadémiai Kiadó Bp. — Bot. Közlem. *54*, 225.
— — c: KRUTZSCH, W.: Atlas der mittel- und jungtertiären dispersen Sporen- und Pollen- sowie der Mikroplanktonformen des nördlichen Mitteleuropas. I—V, 1962, 1963, 1967. — Bot. Közlem. *54*, 115.

1968

— — a: Études palynologiques des couches du Tertiaire inférieur de la Région Parisienne. II. Tableau de quelques espèces et types de sporomorphes. — Pollen et Spores *10*, 117—128.
Key words: Palynology, fossil, stratigraphy, Paleocene, Eocene, France.
— — b: Études palynologiques des couches du Tertiaire inférieur de la Région Paisienne. III. Pollens inaperturés, à ballonnets, polypliqués, monocolpés, disulqués, trichotomosulqués et proxaperturés. — Pollen et Spores *10*, 315—334.
Key words: Palynology, fossil, n. fsp., Paleocene, Eocene, France.
— — c: Übersicht über die Fossil-Flora des Bakony-Gebirges auf Grund palynologischer Ergebnisse. (Ungarisch mit deutsche, franzözische und russische Zusammenfassung). — Veszprém Megyei Múzeumok Közleményei *7*, 91—98.
Key words: Palynology, fossil, Paleozoic — Miocene, Hungary.
KEDVES, M. — ENDRÉDI, L.: Palynologic investigations in the strata of "Buda Marl" with plant remains. - Acta Biol. Szeged. *14*, 11—18.
Key words: Palynology, fossil, Eocene, Hungary.
KEDVES, M. — JURAY, M.: L'importance de la sculpture et des dimensions à la séparation de certaines spores trilètes de *Schizaeaceae*. — Acta Bot. Acad. Sci. Hung. *14*, 71—75.
Key words: Palynology, recent, *Schizaeaceae*, variation-statistic.
KEDVES, M. — KIRÁLY, E.: A propos des régions paléophytogéographiques du Crétacé et du Paléogène, d'après les données palynologiques I. — Acta Biol. Szeged. *14*, 19—28.
Key words: Palynology, fossil, stratigraphy, paleophytogeography, Cretaceous-Tertiary.
KEDVES, M. — SIMONCSICS, P.: Angolai fiatal harmadkori barnakőszenes réteget képező növényegyüttes rekonstrukciója a palinológiai eredmények alapján (Előzetes közlemény). — Bot. Közlem. *55*, 187—189.
Key words: Palynology, fossil, Tertiary, Angola.
KEDVES, M. — URI KISS, I.: Études comparatives sur les pollens du genre *Alnus* du Tertiaire de Hongrie. — Acta Bot. Acad. Sci. Hung. *14*, 315—321.
Key words: Palynology, fossil, *Alnus*, stratigraphy, variation-statistic, Oligocene — Pliocene, Hungary.

Book review

— — : TREVISAN, L.: Pollini fossili del Miocene superiore nei tripoli del Gabbro (Toscana). — Palaeontographia Italica, Pisa 1967, *62*. (N. S. 32.). — Bot. Közlem. *55*, 58.

1969

— — a: Études palynologiques des couches du Tertiaire inférieur de la Région Parisienne. IV. Pollens des *Normapolles*. — Pollen et Spores *11*, 385—396.

Key words: Palynology, fossil, n. fsp., Paleogene, France.

— — b: Palynological Studies on Hungarian Early Tertiary Deposits. — Publishing House of the Hungarian Academy of Sciences, Budapest.

Key words: Palynology, fossil, Paleogene, Hungary.

SIMONCSICS, P. — KEDVES, M.: The pollen grains of the carbonate manganese ore of the Shaft III. in Úrkút. — Acta Miner.-Petr. *19*, 85—94.

Key words: Palynology, fossil, n. fsp., Jurassic, Hungary.

Book review

— — a: STANLEY, E. A.: Upper Cretaceous and Paleocene Plant Microfossils and Paleocene *Dinoflagellates* and *Hystrichosphaerids* from Northwestern Dakota. — Bulletins of American Paleontology Vol. *49*. No. 222., 1965. p. 179—384. — Bot. Közlem. *56*, 148.

1970

— — a: Études palynologiques des couches du Tertiaire inférieur de la Région Parisienne. V. Pollens triporés, subtriporés et intratriporés. — Pollen et Spores *12*, 83—97.

Key words: Palynology, fossil, n. fspp., Paleogene, France.

— — b: Spore-pollen investigations on the Paleocene sediments of Oiching. — Acta Biol. Szeged. *16*, 51—54.

Key words: Palynology, fossil, Paleocene, Austria.

KEDVES, M. — KIRÁLY, E.: Problems of Cretaceous — Palaeogene palaeophytogeographical regions based on palynological results II. — Acta Biol. Szeged. *16*, 63—72.

Key words: Palynology, fossil, paleophytogeographical regions, Cretaceous — Paleogene.

KEDVES, M. — PÁRDUTZ, Á. a: Études palynologiques des couches du Tertiaire inférieur de la Région Parisienne. VI. Ultrastructure de quelques pollens d'*Angiospermes* de l'Éocène inférieur (Sparnacien). — Pollen et Spores *12*, 553—575.

Key words: Palynology, fossil, *Angiospermatophyta*, exine ultrastructure, Eocene, France.

KEDVES, M. — PÁRDUTZ, Á. b: Die Bedeutung ultrastructureller Untersuchungen bei der Lösung entwicklungsgeschichtlicher Fragen der fossilen angiospermatophyten Pollen. (Ungarisch mit deutsche Zusammenfassung). — Bot. Közlem. *57*, 57—58.

Key words: Palynology, fossil, *Angiospermatophyta*, exine ultrastructure, Eocene, France.

KEDVES, M.—ZSIVIN, ZS.: Spore-pollen data from the marl layers of Mte. Bolca. — Acta Biol. Szeged. *16*, 55—68.

Key words: Palynology, fossil, Eocene, Italy.

Book reviews

— — a: KREISHEL, H.: Grundzüge eines natürlichen Systems der Pilze. — G. Fischer, Jena, 1969. — Bot. Közlem. *57*, 8.

— — b: GRUAS-CAVAGNETTO, C.: Étude palynologique des divers gisements du Sparnacien du Bassin de Paris. — Mém. Soc. Géol. France, N.S., 47/2 (Mém. 110) 1968. — Bot. Közlem. *57*, 148.

— — c: SCHELOSKE, H. W.: Beiträge zur Biologie, Ökologie und Systematik der *Laboulbeniales* (*Ascomycetes*), unter besonderer Berücksichtigung des Parasit-Wirt-Verhältnisses. — Parasitologische Schriftenreihe, H. *19*. 1969. — Bot. Közlem. *57*, 148.

1971

— — a: Présence de types sporomorphes importants dans les sédiments préquaternaires Égyptiens. — Acta Bot. Acad. Sci. Hung. *17*, 371—378.

Key words: Palynology, fossil, stratigraphy, Jurassic — Plio-Pleistocene, Egypt.

— — b: Palynology as a tool in geological investigations. — Egyptian Botanical Society Yearbook (1969, 1970), 14—16.
Key words: Palynology, fossil, general problems.
Hegedüs, M., Kedves, M. — Párdutz, Á.: Ultrastructural investigations on fossil angiosperms exines of Upper Cretaceous. — Advancing Frontiers of Plant Sciences *28*, 317—329.
Key words: Palynology, fossil, Hungary, Portugal.
Kedves, M., Hegedüs, M.—Bohony, E.: *Normapolles* taxa from Palaeocene sediments. — Acta Biol. Szeged. *17*, 49—62.
Key words: Palynology, fossil, n. fgen., n. fspp., Paleocene, Austria, France.
Kedves, M., Hegedüs, M.—Párdutz, Á.: Ultrastructure investigations on the exine of the genus *Casuarina* L. — Acta Biol. Szeged. *17*, 63—65.
Key words: Palynology, recent, *Casuarina*, exine ultrastructure.
Kedves, M.—Simoncsics, P.: Investigation of spores and pollen grains of the carbonate manganese ore bore samples from Úrkút. — Acta Miner.-Petr. *20*, 85—96.
Key words: Palynology, fossil, n. fsp., Jurassic, Hungary.

Book review

— — : Krutzsch, W.: Atlas der mittel- und jungtertiären dispersen Sporen- und Pollen-, sowie der Mikroplanktonformen des nördlichen Mitteleuropas. VII. — Monoporate, monocolpate, longicolpate, dicolpate und ephedroide (polyplicate) Pollenformen. — G. Fischer, Jena, 1970. — Bot. Közlem. *58*, 238.

1972

— — a: Fosszilis sporomorfák ultrastruktúrája. — Doktori értekezés tézisei, 1—13.
Key words: Palynology, fossil, *Pteridophyta, Gymnospermatophyta, Angiospermatophyta.*
Hegedüs, M., Kedves, M.—Párdutz, Á.: Ultrastructural investigation of Upper Cretaceous angiosperm exines II. — Acta Biol. Szeged. *18*, 55—69.
Key words: Palynology, fossil, *Angiospermatophyta*, exine ultrastructure, Cretaceous, Egypt, Hungary, Portugal.
Kedves, M.—Hegedüs, M.: Periporat-Pollenkörner aus den oberkretazischen Ablagerungen Portugals. (Ungarisch mit deutsche Zusammenfassung). — Bot. Közlem. *59*, 19—21.
Key words: Palynology, fossil, n. fspp., Cretaceous, Portugal.
Kedves, M.—Párdutz, Á. a: Fosszilis *Pteridophyta* spórák és *Gymnospermatophyta* pollenszemek ultrastruktúra vizsgálata. — X. Biol. Vándorgy. Előad. Ism., 144.
Key words: Palynology, fossil, *Pteridophyta, Gymnospermatophyta*, wall ultrastructure.
Kedves, M.—Párdutz, Á. b: Elektronmikroszkópos vizsgálatok fosszilis zárvatermő polleneken. — Őslénytani Viták *20*, 71—75.
Key words: Palynology, fossil, *Angiospermatophyta*, Cretaceous.
Zaklinskaia, E., Kedves, M., Hegedüs, M.—Párdutz, Á.: Étude de l'ultrastructure du genre de forme *Betpakdalina*. — Pollen et Spores *14*, 323—332.
Key words: Palynology, fossil, *Angiospermatophyta*, exine ultrastructure, Kazakhstan.

1973

— — a: Paleogene fossil sporomorphs of the Bakony Mountains. Part I. — Studia Biologica Academiae Scientiarum Hungaricae 12. Publishing House of the Hungarian Academy of Sciences, Budapest.
Key words: Palynology, fossil, n. fspp., *Pteridophyta,* Paleogene, Hungary.
— — b: The present state of ultrastructural research into fossil sporomorphs. — Acta Biol. Szeged. *18*, 13—18.
Key words: Palynology, fossil, ultrastructure evolution.
Kedves, M., Hegedüs, M.—Párdutz, Á.: L'étude de l'ultrastructure des pollens fossiles des *Angiospermes* du Crétacé supérieur et du Tertiaire inférieur. — Proc. III. IPC, Morphology and systematics of fossil pollen and spores, 31—33.
Key words: Palynology, fossil, *Angiospermatophyta*, exine ultrastructure.

KEDVES, M.—PÁRDUTZ, Á. a: Ultrastructure examination of fossil *Pteridophyta* spores and *Gymnospermatophyta* pollens. — Acta Bot. Acad. Sci. Hung. *18*, 307—313.
Key words: Palynology, fossil, *Pteridophyta, Gymnospermatophyta*, exine ultrastructure.
KEDVES, M.—PÁRDUTZ, Á. b: Ultrastructural studies on *Amentiflorae* pollen grains I. — Acta Biol. Szeged. *19*, 19—32.
Key words: Palynology, recent, *Amentiflorae*, exine ultrastructure.
KEDVES, M.—PÁRDUTZ, Á. c: Ultrastructure investigations of *Angiospermatophyte* pollens from the Lower Eocene. — Acta Bot. Acad. Sci. Hung. *18*, 135—154.
Key words: Palynology, fossil, n. fgen., n. fsp., *Angiospermatophyta*, exine ultrastructure, Eocene, France.

Book reviews

— — a: HEYWOOD, V. H.: Taxonomie der Pflanzen. — G. Fischer Verlag, Jena, 1971. — Bot. Közlem. *60*, 42.
— — b: PANKOW, H.: Algenflora der Ostsee. I. — G. Fischer Verlag, Jena, 1971. — Bot. Közlem. *60*, 33.

1974

— — a: Paleogene fossil sporomorphs of the Bakony Mountains. Part II. — Studia Biologica Academiae Scientiarum Hungaricae 13. Publishing House of the Hungarian Academy of Sciences, Budapest.
Key words: Palynology, fossil, n. fgen., n. fspp., Paleogene, Hungary.
— — b: Electron microscopic examinations in pollen grains of fossil *Angiosperms*. (Hungarian, with English summary). — Bot. Közlem. *61*, 283—287.
Key words: Palynology, recent, fossil, TEM, SEM.
DINIZ, F., KEDVES, M.—SIMONCSICS, P.: Les sporomorphes principaux de sédiments crétacés de Vila Flor et de Carrajão, Portugal. — Com. Serv. Geol. Portugal *58*, 161—183.
Key words: Palynology, fossil, n. fgen., n. fspp., Cretaceous, Portugal.
KEDVES, M.—PÁRDUTZ, Á. a: Ultrastructural studies on Amentiflorae pollen grains, II. — Acta Biol. Szeged. *20*, 69—80.
Key words: Palynology, recent, *Amentiflorae*, exine ultrastructure.
KEDVES, M.—PÁRDUTZ, Á. b: Ultrastructural studies on Mesozoic inaperturate *Gymnospermatophyta* pollen grains. — Acta Biol. Szeged. *20*, 81—88.
Key words: Palynology, fossil, *Gymnospermatophyta*, exine ultrastructure, Mesozoic, Egypt.
KEDVES, M., STANLEY, E. A.—ROJIK, I.: Observations nouvelles sur l'ectexine des pollens fossiles des *Angiospermes* de l'Éocène inférieur. — Pollen et Spores *16*, 425—437.
Key words: Palynology, fossil, TEM, biopolymer structure, Eocene, USA.
PÁRDUTZ, Á., JUHÁSZ, M., DINIZ, F.—KEDVES, M.: *Teixeiraipollenites globosus* n. fgen. et fsp. du Crétacé supérieur de Portugal et étude de l'ultrastructure de son exine. — Com. Serv. Geol. Portugal *58*, 181—194.
Key words: Palynology, fossil, n. fgen., n. fsp., exine ultrastructure, Cretaceous, Portugal.

Book reviews

— — a: JACOBSEN, H.: Das Sukkulenten Lexikon. — VEB Fischer Verlag, Jena, 1970. — Bot. Közlem. *61*, 184.
— — b: LIEBENOW, H.—LIEBENOW, K.: Giftpflanzen Vademekum für Tierärzte, Humanmediziner, Biologen und Landwirte. — VEB Fischer Verlag, Jena, 1973. — Bot. Közlem. *61*, 184.

Chronicle

Visiting scientists

Dr. M. T. Fernandez Marrón (U.E.I. of Paleontology, Institute of Economic Geology, C.S.I.C.—U.C.M., Madrid, Spain).

Her stay in the laboratory — 19. 5. 1992 — 29. 5. 1992. — was a part of the joint research program: "Estudio de diversos aspectos paleobotánicos del Cretácico superior del Cerro de la Mesa (Norte de la provincia Madrid)". As the first paper of this program the 2nd contribution of this number was completed. Moreover an abstract for the 9th Simposio de Palinologia, A.P.L.E. (Las Palmas, Gran Canaria) was also prepared.

26, 27. 5. 1992. — Katarina Dujmovic-Krizmanic (Croatian Natural History Museum, Zagreb, Croatia) and Kresimir Krizmanic (INA — NAFTAPLIN, Geological Exploration and Development Division, Laboratory Research Department, Zagreb, Croatia) — visited the laboratory. The aim of this visit was in the first place to establish personal contacts, and to discuss about the research programs and projects of the respective laboratories.

Dr. Shyam C. Srivastava, Assistant Director and Head of Mesophytic Evolutionary Botany, Convener-Secretary of Birbal-Savitri Sahni Foundation (686, Birbal Sahni Marg., Lucknow, India), visited Hungary. From September 3 to 6 in Szeged, then up to 10 September in Budapest. In Szeged he studied the different kinds of research programs and activities of the laboratory. In Budapest, the collections of the plant macroremnants were the subject of his investigations.

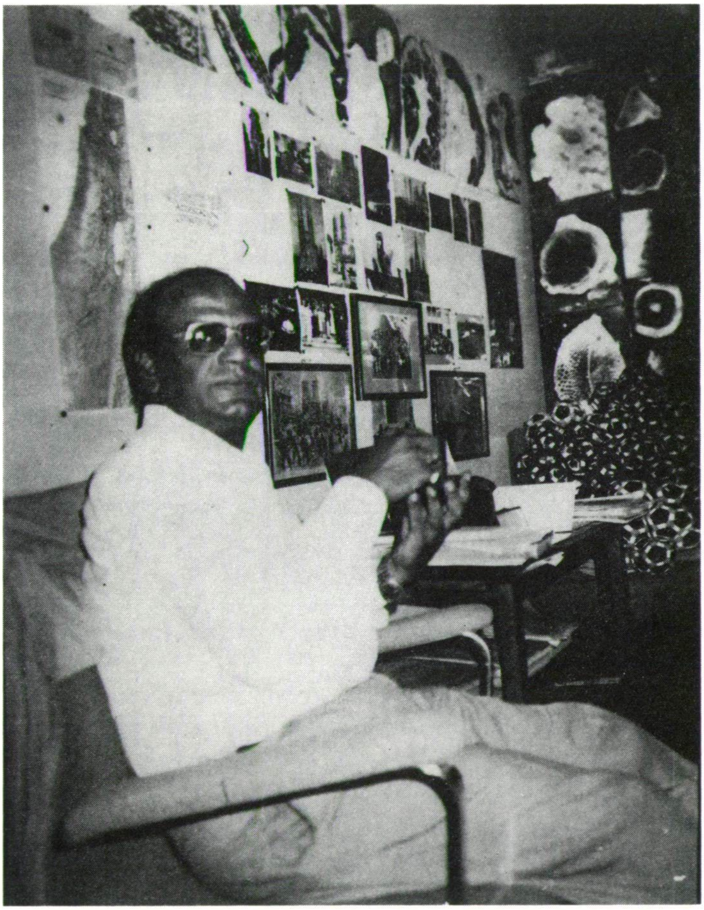
International laboratory activity

Workshop on Pyrolysis in Organic Geochemistry International Workshop, June 9—11, 1992, Szeged, Hungary.

Kedves, M., Rojik, I. and Vér, A.: Ultrastructure and biopolymer organization of the *Botryococcus* colonies from Hungarian alginite. — Abstracts, 21, 22.

Sajgó, Cs., Hetényi, M. and Kedves, M.: Palynology and organic geochemistry of Tertiary low rank coals in Hungary. — Abstracts, 36, 37.

From July 21 until July 24, Dr. M. Kedves and G. Jerinic M.Sc. (Geological Institute, Zagreb, Croatia) visited Slovenia. Under the guidance of Dr. B. Jelen (Geological Institute, Ljubljana, Republic of Slovenia) the following Paleogene layers were investigated: Sava Folds (Zagorje — Lasko Syncline), Lower "Socka Beds", coal, Upper "Socka Beds", Oligocene Marine Clay. Coal bearing strata containing palynological assemblages of the type of Dorog, Tatabánya, Dudar and Balinka were investigated in the environment of Velenje, Doberna, Socka, Konjiska gora, Klece and Makole. At Lepena the stratigraphical section of coal bearing strata containing Eocene molluscan fauna, similar to the Dorog Basin (Hungary) were studied. During this visit several discussions were carried on, and publications and further cooperations were planned. A paper concerning the spore-pollen assemblages of "Dorog type" in Slovenia, Middle Eocene is in progress, and is to be published soon.



A photograph of Dr. S. C. SRIVASTAVA in the office of Dr. M. KEDVES. The picture was taken by Dr. É. SIPOS–KEDVES.

8th International Palynological Congress, September 6—12, 1992, Aix-en-Provence, France.

KEDVES, M.: Upper Cretaceous paleophytogeography on palynological basis. — Abstracts, 74.

KEDVES, M., FARKAS, E., GOTTL, E., MÉSZÁROS, K. et TÓTH, A.: L'importance des formes secondaires des sporomorphes produites par voie expérimentale. — Abstracts, 75.

KEDVES, M., TÓTH, A. and FARKAS, E.: Experimental investigation of the biopolymer organization of the sporoderm (recent and fossil). — Abstracts, 75.

From 5 October until 19 October Dr. M. KEDVES worked in the Department of Paleontology (Facultad de Ciencias Geologicas, Universidad Complutense de Madrid) as visiting scientists together with Prof. Dr. C. ALVAREZ RAMIS and Dr. M. T. FERNANDEZ MARRÓN on the previously mentioned joint research program.

9° Simposio de Palinologia A.P.L.E., Las Palmas de Gran Canaria, 30 — Noviembre / 4 — Diciembre 1992.

ALVAREZ RAMIS, C., KEDVES, M. y FERNANDEZ MARRÓN, T.: Asociaciones esporopolinicas del Cretacico superior del Cerro de la Mesa (Guadalix de la Sierra, Provincia de Madrid). — Resumenes, 28.

KEDVES, M. et TÓTH, A.: Premiers resultats du système de biopolymère stabilisateur du squelette quasi-cristalloïde de l'exine. — Resumenes, 20.

Hungarian scientific activities

Symmetry — Asymmetry

Conference, March 26—27, 1992, Szeged, Hungary.

KEDVES, M.: Biopolimer struktúrák szimmetriája.

Paleobotany and Environment

Contributions, May 18, 1992, Budapest, Hungary.

KEDVES, M.: A növényi mikroszkópos maradványok paleoökológiai jelentősége.

Laboratory meetings

21.2.1991, speaker: KEDVES, M.: Three dimensional modelling of the biopolymer systems of the sporoderm.

Report from the participation of the XIIth Symposium of the A.P.L.F. "Biogeographie et Palynologie", Caen 23—27, September, 1991, France, speaker: KEDVES, M.

6.3.1991, speaker: KEDVES, M.: Trends of the multidisciplinary micropaleontology and its practical connections.

Report from the field trip in Egypt—I, speaker: KEDVES, M.

24.4.1992, speaker: GÁSPÁR, I.: Review of the paper of GOLENBERG, E. M., GIANNASI, D. E., CLEGG, M. T., SMILEY, CH. J., DURBIN, M., HENDERSON, D. and ZURAWSKI, G. (1990): Chloroplast DNA sequence from a Miocene *Magnolia* species. — Nature *344*, 656—658.

Report from the field trip in Egypt—II, speaker: KEDVES, M.

20.10.1992, speaker: KEDVES, M.: Report on foreign study-tours. Discussion of the up-to-date research programs of the laboratory.

6.11.1992, speaker: VÉR, A.: Discussion of her certificate dissertation.

Report on foreign trips in 1992: Cyprus, Egypt, Slovenia, Aix-en-Provence, Arles, Camargne, Madrid, speaker: KEDVES, M.

Teaching program of the laboratory

During the last two semesters the following lectures were delivered:
Introduction to the plant micropaleontology of pre-Quaternary deposits, 1+2 hours weekly.
Organizations levels of the biopolymer system of the plant cell wall, 1+2 hours weekly.
Theory of the evolution and its natural phylosophical relations, 1 lecture weekly.

Responsible for publication: M. Kedves
Responsible editor: Gy. Györffy
Cover by A. Hegedüs
Set in New Time 10/11 point
93-19 — Szegedi Nyomda

E, H MA 2001.01.24.

+ 1 vétel